Interactive media in distance learning for UK farmers: the countryside disc

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Interactive Media in Distance Learning for UK Farmers: The Countryside Disc

Palitha Edirisingha
BSc MEd

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Abstract

How might UK farmers benefit from using interactive computer-based media? These farmers need to learn how to change their practices in a rapidly changing economic and social environment. They have difficulty in obtaining suitable training through conventional audio-visual media and face-to-face sessions. How would they benefit from learning at a distance, using computer-based media in their own homes and offices?

This thesis presents a naturalistic study of how a number of UK farmers benefited from using the Countryside Disc, one of the few examples available of an interactive training program aimed at farmers. The Disc, which is a computer-controlled laser vision videodisc, required the farmers to act in a complex simulated world (of a farm and its social and ecological environment) in which they received frequent and immediate feedback concerning the consequences of their actions.

After a pilot study to develop the methodology, the main study involved observation and recording of 10 farmers' interactions with the Disc.

The farmers engaged in hundreds of instructional interactions with the Disc. Each farmer's approach to learning changed as he or she worked through the program, and was clearly related to the learning outcomes for that person. The Disc demanded a deep approach: two farmers who attempted to use a surface approach were unable to continue.

The farmers drew heavily on their experience in the real farming world and the frequent feedback prompted them to be reflective on both that experience and the training offered by the Disc.

They also encountered a range of navigational problems, most of which could be reduced or eliminated through redesign of the Disc.

The most important finding was that farmers, through using the Countryside Disc, received training, in their homes and offices, in (a) gaining deep understanding of the interplay of factors involved in present-day farming, and (b) making profitable farm management decisions – while observing relevant regulations and being responsive to the opinions of interest groups.

The thesis concludes with a discussion of the findings in the light of theories advanced by Marton and Säljö on deep and surface learning, by Laurillard on conversational framework and by Schön on reflective practitioners. It includes suggestions for further research.

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Chapter 1
Introduction

This thesis investigates how UK farmers might benefit from learning at a distance, using interactive media. Chapter 1 sets the scene for the study. It shows how the importance of such a study stems from a growing necessity to change existing farming practices in the UK. After reviewing current methods and media used for farmers' training in the UK, it points out their limitations and suggests a new approach. Finally it outlines the structure of the thesis.

1.1 The background

1.11 The importance of UK agriculture sector

Within an industrialised economy, the UK agriculture sector is relatively unimportant if judged by basic economic criteria. According to the Ministry of Agriculture, Fisheries and Food (MAFF), the sector had a gross domestic product (GDP) of about £7.6 billion in 1993, only 1.4% of the total GDP for that year (MAFF, 1994). This figure suggests that the contribution of agriculture to the national economy is remarkably small in comparison to other sectors, and it has been falling: the percentage contribution to GDP for 1984 was 2%. The number of people employed in the sector is also very low, at a little over 0.5 million, 2.2% of the total population of the United Kingdom.

Although the contribution of agriculture to the economy is small, farming occupies a major portion (77%) of the UK land area, around 18.5 million ha (MAFF, 1994). The impact of activities that occur in more than three-quarters of the land area of the country needs to be considered. Also, as Houseman (1993) reports, agriculture plays a major role in the rural economy and occupies a much higher proportion of the work force in regions such as Wales. In remote rural areas, agriculture and the associated support industries often account for 20% of the working population. Thus it is important to be concerned about what farmers do and what is happening in the agriculture sector.

1.12 The changing objectives of the UK agriculture sector

The objectives of the agriculture sector have been changing, especially in the latter part of the century (Houseman, 1994). Soon after the Second World War, the sector's objective was to get the maximum level of production, using higher levels of inputs. This was necessary to meet the increasing demand for food. But around 1960 the objective was changed to obtaining optimum levels of production, using inputs more efficiently rather than merely using more and more inputs. The last change in the objective occurred in the 1980s when the UK joined the Common Agricultural Policy (CAP). Since then, how farming is done in the UK is largely determined by regulations imposed by the European Economic Commission (EEC), some to prevent surplus production.

Furthermore, the general public has become increasingly concerned about farming methods and the effects of farming activities on the environment and health. Conservation, environment, animal welfare and food safety are on the agenda for public debate. These changing attitudes have influenced EEC farming regulations, and have important bearings on present-day farming. The sum effect has been to introduce more environmentally sustainable and more extensive production systems, with efficient use of available inputs (Lane et al, 1988).

1.13 Emerging training needs

Under these new conditions, farmers need to acquire a diversity of knowledge and skills in order to farm profitably (Mason, 1995; Damms and Stone, 1995; Beel, 1994; Houseman, 1994; Wilkinson, 1994). They have a range of new training needs, in three broad categories. First, farmers need to be constantly updated regarding the debate about farming, the environment and the countryside. Second, farmers need to receive training to help them to comply with health, safety and environmental regulations. Thirdly, and most importantly, farmers must acquire the skills needed to farm profitably under current conditions, while responding to the demands of the general public and observing the regulations. They also need to learn farm diversification techniques, to earn profits from new ventures. Fig. 1.1 summarises how these three categories arise.

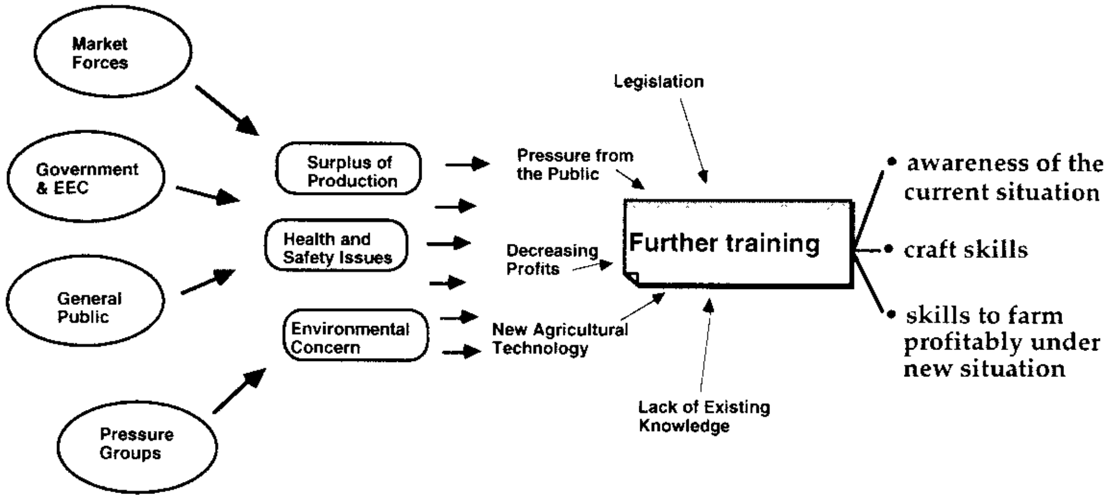

Fig. 1.1: Origins of farmers' training needs

Training is a vocational education activity aiming to achieve work- and income-related goals (Rachal, 1988). Hawkridge (1995), taking examples from the corporate sector, points out that training gives workers the skills, knowledge and attitudes required to do their jobs well and safely. Training can lead to increased income, through better quality products and improved services to customers. Similarly, training for farmers can lead to increased profits while they observe current regulations.

1.2 Existing training methods and media

Professional training and education for the farming community is catered for in the UK (Lane et al, 1988), through three categories of training providers:

1 Farm-based training
2 Advisory and consultancy services
3 Study centre-based courses

Farm-based training is mainly provided by the Agricultural Training Board Landbase (ATB Landbase), a government organisation. It uses an 'employer-led training' scheme (Beel, 1994). Farmers in a local area get together and form a training group, the average size being about 30. The group selects a chairman and a treasurer, and employs a part-time training organiser. The training organiser visits every member of the group annually, usually during a period when farmers are less busy, and, in consultation with the whole group of farmers, identifies training needs and plans courses. Training is done on the farmers' own farms, usually from November to March, the average training period being two days. Some independent training providers also offer similar training.

Advisory and consultancy services are provided by the Agriculture Development and Advisory Service (ADAS). ADAS conducts method and result demonstrations both in its research centres and on clients' farms, and organises open days for farmers. The media used are mostly printed materials that are posted to the farmers. Slides, overhead projectors and videocassettes are also used in training programmes (Houseman, 1994). Chemical companies and some independent organisations provide similar services.

Study centre-based courses are provided by about 50 agricultural colleges (Lane et al, 1988). Agricultural departments in some further education colleges and universities also provide this type of training. These courses are mainly residential and lead to formal qualifications.

1.21 Limitations of existing training

Organisations mentioned above provide training face-to-face, using conventional media where necessary. How far are these training methods successful for farmers? Farmers are adults, engaged in a full-time vocation. The characteristics they possess both as adults and as farmers have a significant effect on the success of the training method they use. Adults display learning characteristics that are quite different from those of children (Knowles, 1990).

Ference and Vockell (1994, p.25) summarise some of the traits of adult learners identified by Knowles (1990) and Lindeman (1926). Adults prefer to participate actively rather than passively in the learning process. They are capable of being more self-reliant and want to accomplish things for themselves. They are also inclined to draw and rely on their own personal experiences and knowledge to solve problems. Also they prefer to learn by doing rather than by listening, since they have always acquired skills through concrete, hands-on experience. Adult learners tend to focus on real-world situations. They usually perceive themselves to be independent and responsible for their own actions and prefer to be directly involved in planning and directing their learning activities.

Most of these learning traits are exploited by existing training. The ATB Landbase programmes are mostly organised by farmers themselves and cater only for a small group, on a local farm where they can get hands-on experience. Farmers learn by doing, rather than by listening to lectures and seminars. Similarly, farmers seek advice from ADAS of their own volition. These face-to-face methods seem satisfactory for farmers.

However, the nature of farming as an occupation may influence the choice of face-to-face training. Are farmers available for training? They are usually busy throughout the year, particularly from April to October, and can spare time for training only during the winter. Dairy farmers can spare only certain times of the day. Beel (1994) believes that ATB Landbase's employer-led training method is a fitting model for farmers, because they can train in winter. Wilkinson (1994) notes that farmers can still attend short courses at college, because they can get time off at certain times of the day or certain times of the year. But what about training needs arising during planting or harvesting? It is more useful to fulfil a training need when it arises. Hawkridge et al (1988), commenting on the farmers' situation, note that they need to train themselves without leaving the farm, and must be able to update their knowledge at any time when decisions are required, rather than the time when a particular course is being offered. Face-to-face training at certain times of the year has limitations, as far as farmers are concerned.

Most farms employ small numbers of people because of mechanisation of agriculture and increasing cost of labour. Thomas, a farmer who took part in this research, employs only four people on his farm which covers more than half the village (Thomas, 1996). Forty years ago, his farm employed more than a third of the population of the village. Decreasing labour on farms has implications for training needs in addition to farmers' availability for training. Scarcity of farm workers means that those few who are actually employed should be able to carry out a variety of tasks on the farm – they have more training needs.

In some situations, remoteness also affects farmers' availability for training. Houseman (1994) points out that remoteness may not be a problem in the UK as a whole, but in areas such as Wales, the South West and some parts of Scotland this may be a big issue. Farmers may have to take a ferry or a flight to attend training sessions, and this may be inconvenient for isolated farmers.

Farmers' attitudes towards training are an important element. Damms and Stone (1995, p. 115) note that there is strong evidence suggesting 'that agriculture in the UK has a history of apathy towards the uptake of training courses'. Whitlock (1994) and Rabbich (1994) confirm that farmers as a group have a reserved attitude towards training. They comment that farmers show resentment towards any kind of outside interference in their lives. This may be due to their geographical isolation together with lack of time for socialisation. Also they comment that farmers are very independent and feel their farms are big enough for them to survive alone, therefore it may be difficult for farmers to accept change.

1.3 A new approach

So, uptake of any education and training programme in farming is always limited by a range of constraints. In other sectors, distance learning has proved to be a useful method to overcome these limitations, while providing effective learning (Keegan, 1996; Moore, 1989). Distance learning could possibly meet the training problems farmers face. It is 'organised learning ... based on the physical separation of learners and those ... involved in the organisation of learning' (Tight, 1988, p. 59). Distance learning through new interactive media may be best because it can solve some of the logistical problems. Geographically isolated farmers who have less time to attend conventional training may want to use interactive media to learn at home, at convenient times and at their own pace. Provision of distance learning using 'stand-alone media' may be cost effective, too (Keegan, 1996; Romiszowski, 1988). Individualisation of instruction through interactive media can improve student autonomy. The interactivity provided by these media can help the farmers, leading to better learning outcomes and positive attitudes towards learning.

The broad research objective of this thesis is to investigate how UK farmers might benefit from interactive media in distance learning. Chapter 2 discusses two categories of interactive media: computer-based media and conferencing media. In order to achieve the broad research objective, this thesis will take the Countryside Disc as an example of computer-based media, and investigate how it provides effective learning for farmers at a distance.

1.4 The structure of the thesis

Chapter 1 describes the background, showing the importance of this study for UK farmer training. After reviewing current training methods and media used for farmers' training in the UK, it points out their limitations and suggests a new approach.

Chapter 2 contains the literature review for the study and refines the research problem. It highlights the characteristics of distance education and discusses attempts to provide distance learning for UK farmers. It critically examines audio-visual media used in distance learning and points out their limitations. It then discusses interactive media and defines fully the concept of interaction. Later it discusses various types of interactive media and narrows down to the specific computer-based media used for the research. Finally, it states the research problem.

Chapter 3 describes the program used for the study, The Countryside Disc, an interactive videodisc that presents an extensive and complex simulation of an English farm and its surrounding area. The chapter first outlines criteria for selecting a suitable program. It then describes and compares three programs that were considered for their suitability. Finally, the chapter gives a detailed account of the Countryside Disc, the program selected.

Chapter 4 is on the research methodology. It begins by introducing and comparing two main research paradigms, leading to a justification of the paradigm adopted in the current study. It then outlines the guidelines of the naturalistic paradigm, adopted for the current study. Finally, it lays down the research design with an account of how the field work was carried out in three stages. Chapter 4 ends by describing how the data were analysed.

Chapter 5 describes and discusses the pilot study, which had two broad objectives: to identify important aspects for further investigation in the main study and to test the research methodology. First, it mentions the focus of the study. Second, it gives a detailed account of analysis of the data. Finally it summarises the outcome of the pilot study and states the categories identified for the main study: farmers' learning style and navigational problems.

Chapters 6, 7 and 8 analyse data pertaining to the learning style.

Chapter 6 analyses how the individual farmers got information from the program. It begins by describing the set of criteria, called indicators of learning, designed to measure individual farmer's effort to learn from the program. It goes on to analyse how each farmer obtained information from the program. Based on this analysis, the chapter shows the evidence of differences in individual farmers' approach to learning.

Chapter 7 analyses how the farmers took decisions and made inputs to the program. The analysis focuses on two aspects: how the farmers reacted when the program did not allow their decisions, and how the farmers' decision-making process was influenced by their particular approach to getting information. The chapter concludes that there appears to be a relationship between the individual farmers' approach to learning from the program and making decisions.

Chapter 8 considers the plans that farmers make as the final product of their learning sessions, and uses them to gain an insight into the learning outcome. It analyses first the outcome of each individual farmer's plan and how it is influenced by the approach to learning, and then the farmers' reactions to the feedback and its implications for learning from the program. This chapter concludes that there is a positive relationship between the kinds of plans the farmers made and their approach to learning from the program. It also concludes that the feedback provided by the program provoked the farmers to reflect on their actions leading them to take a deep approach to learning.

Chapter 9 discusses the findings of the data analysis pertaining to learning style (from Chapters 6, 7 and 8), within three theoretical frameworks: Marton and Säljö's 'deep' and 'surface' approaches to learning, Laurillard's 'conversational framework' and Schön's 'reflective practitioner'. The analysis is done under two main headings: 'Relationship between the learning approach and the learning outcome' and 'Special characteristics of the learning experience'.

Chapter 10 analyses the navigational problems farmers faced and discusses their implications for learning, specifically from the Countryside Disc, and generally from similar computer-based media. First, it discusses the reasons for navigational problems in computer-based media. Second, it categorises and analyses the navigational problems the farmers faced. Third, it discusses the implications of these navigational problems for farmers' learning from the Countryside Disc. Fourth, it discusses the solutions suggested in the literature, and finally it suggests some solutions to overcome the navigational problems that the Countryside Disc posed.

Chapter 11 provides the study's conclusions. It summarises the main outcomes of the research, provides a critical reflection on the work and advances recommendations and suggestions for further work.

Appendix 1, 'Special cases', analyses the case of two farmers who were not able to complete the learning task in the main study. It describes how these two users interacted with the program, explores the specific problems they encountered and points towards the causes of such problems. Where necessary, the findings of this section are referred to earlier in the thesis.

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Chapter 2
Methods and media for learning

This chapter contains the literature for the study and refines the research problem. First, it highlights the characteristics of distance education and discusses attempts to provide distance learning for UK farmers. Second, it critically examines audio-visual media used in distance learning and points out their limitations. Third, it discusses interactive media and defines fully the concept of interaction. Later it discusses various types of interactive media and narrows down to the specific computer-based media used for the research. Finally, it states the research problem.

2.1 Distance education and distance learning

Distance education provides opportunities for learners who are otherwise unable to enrol in conventional face-to-face education. Reporting on the nature of distance education, Keegan (1990) mentions that distance education provides a complete educational programme for both children and adults outside of and distinct from conventional education. Moore (1989a) also points out that distance education can empower office, factory and farm workers. Distance education can provide knowledge of new techniques to maintain or change employment, and can make courses available to the individual learner in many geographic locations. Keegan (1990, p. 3) talks about an important contribution of distance education: 'distance education has opened access to study towards all levels of qualification to the working adult – the student who continues to contribute to the nation's Gross National Product throughout the length of his or her study programme'.

2.11 Characteristics of distance education

Keegan (1990, p. 44) lists the following characteristics of distance education by synthesising definitions from Dohmen (1967), Peters (1973), Moore (1973) and Holmberg (1977):

1. the quasi-permanent separation of teacher and learner throughout the length of the learning process
2. the influence of an educational organisation both in the planning and preparation of learning materials and in the provision of student support services
3. the use of technical media – print, audio, video or computer – to unite teacher and learner and carry the content of the course
4. the provision of two-way communication so that the student may benefit from or even initiate dialogue, and
5. the quasi-permanent absence of the learning group throughout the length of the learning process so that people are usually taught as individuals and not in groups, with the possibility of occasional meetings for both didactic and socialisation purposes.

Rumble (1989) notes that there are different opinions about some characteristics of distance education because this is a term that embraces a wide range of educational activities. Keegan (1990, p. 6) asserts, however, that 'distance education is a coherent and distinct field of educational endeavour': it embraces all kinds of education including primary, secondary, technical, further, college and university, public and private, existing for over 100 years.

Separateness, the first characteristic, which both Rumble (1989) and Moore (1989a) agree, is the main one for distance education. The teacher or the teaching institute is separate, either in place or time, or both, from the learners. This distinguishes distance education from face-to-face conventional education. The second characteristic is the influence of an educational organisation in the provision of teaching and administration. Based on this characteristic, Keegan distinguished distance education from private study and teach-yourself programmes.

The first and the second characteristics give rise to different opinions on the nature of separation between the learner and the teacher and the extent to which the learner is given support and controlled by the teaching institution (Rumble, 1989). This has implications for the definition of the distance teaching institution – does it have to be a well defined institution, or can it be a person who provides the distance learning?

Rumble points out that Keegan, in defining distance education, excluded all forms of education that lack the structuring of an educational institution. He argues that private communication between an individual in the role of the teacher and another in the role of the student can be a form of distance education in the same way as private tuition between teacher and pupil, arranged outside the school, is a form of face-to-face education. Rumble thus broadens the idea of distance education to include all forms of instruction that do not require the student to attend regularly the educational institution that sponsors the instruction. This suggestion implies that an institution responsible for teaching at a distance need not be large and that it is perfectly possible for distance education to occur between a single teacher and a single student.

The separation of teacher and learner consequently gives rise to the third and the fourth characteristics of distance education. The third characteristic is the use of technical media to carry out the educational activity. Distance education has to rely on the technological media to provide the communication link between the teacher and the learner. According to Keegan these media are used to 'unite teacher and learner and *carry the content of the course*' (1990, p.44, emphasis added). Clearly most traditional media are one-way vehicles of information, limiting two-way communication between the student and the teacher. The importance of facilitating two-way communication in distance education is emphasised by Holmberg (1990). Keegan cites the provision of two-way communication as the fourth characteristic of distance education. Unlike conventional education, there is little opportunity for two-way communication in distance education since the teacher and the learner are usually separated in space and time. Distance education relies on technical media to facilitate two-way communication.

The use of new interactive media to facilitate this has given rise to another difference in opinions. Garrison and Shale (1987, cited by Rumble, 1989) raise the question of whether self instruction from computer-based media can be counted as distance education. Ljoså's (1988, cited by Rumble, 1989) opinion is that a distinction needs to be maintained between real and simulated distance education. Ljoså maintains that he 'would prefer not to use the expression two-way communication when the process of communication from one side is entirely pre-programmed' (ibid., p. 15). Two-way communication must be able to respond to any query or mistake on the part of the learner, even if the response can only direct the student to obtain further advice elsewhere. This implies the need for a human agent. According to this view, independent study falls outside the scope of distance education.

Advances in new communication technologies in the 1990s challenge these views. For instance, conferencing technologies challenge the fifth characteristic of distance education, i.e., learning as an activity carried out individually and in isolation throughout the length of the learning process. Whatever the technology, learning in a distance education system can correctly be called distance learning.

2.12 Attempts to provide distance learning for UK farmers

What about a farmer who wants to learn by himself or herself without looking for qualifications? Does such a learning activity count as distance education? Is a lone farmer studying from a computer program a distance learner? These questions are important in deciding upon distance education for farmers.

There have been few attempts to provide distance learning for farmers in the UK. One such attempt was the 'Health and Productivity of Dairy Cattle' course provided by the Open University together with the ATB and the Royal Veterinary College (Holmes, 1994; Lane et al, 1988). The objective was to show dairy farmers and workers how an improvement in the health and productivity of their herds could be brought about. The course consisted of print, audio tapes, television programmes, tutor-marked assignments and occasional face-to-face tutorials, and ran from 1984 to 1988.

Holmes (1994) asserts that the OU course presented an interesting learning experience for the farmers. It was a new venture for them because they were used to other kinds of learning. Students were well motivated to study because of this novelty. He points out that the farmers who took the course did at least as well as the OU's undergraduates and were highly motivated.

A number of other distance learning agriculture courses, some of them aimed at farmers, are provided in the UK. The International Correspondence School in Glasgow (MacDonald, 1994), Capel Manor Horticultural and Environmental Centre in Enfield, Middlesex (Dowbiggin, 1994), the Horticultural Correspondence College in Chippenham, Wiltshire (Elms, 1994) and Agricola Training Limited in Lincoln (The Open Learning Directory, 1996) are some of them. These institutes depend mostly on printed material for the delivery of their courses.

Agriculture is predominantly practical. Most of the learning must be done on the farm or at a college. Which subjects can be successfully learned at a distance? Wilkinson (1994) argues that courses offered by agricultural colleges are generally not suited to distant learning, because the learner needs to be on the site with the instructor. Beel (1994) says training farmers in practical skills at a distance is a difficult task.

Others hold the view that some aspects of agriculture could be delivered through distance education. Drawing on the experience of providing a higher degree course in agriculture, Bryson (1994) points out the possibility of teaching some theoretical aspects of agriculture in the distance mode to those who are already involved practically. The OU course shows this to be feasible. Holmes (1994) explains that it taught the theoretical knowledge the dairy farmers needed to understand their business properly.

A successful minor application of distance learning in ADAS is the use of plastic-coated cards to identify pests and diseases, according to Houseman (1994). Moulton Agricultural College plans to provide a distance-taught Higher National Certificate course in rural diversification: this is to be part-time, combining distance study with occasional college attendance.

Most of the above attempts include media such as printed material and audio cassettes to deliver the content. Only the OU course used television and video recordings, as well. These are audio-visual media, according to Laurillard's (1993) media analysis.

2.2 Audio-visual media

As the term implies, there are two main components that make up audio-visual media: audio and visual. The learning material may be in audio or visual form, separately, or a combination of both. The visual component may be text, graphics or a combination of both. The graphic component may consist of illustrations, still photographs, moving pictures, etc. The delivery of the learning material may be through the print medium (as in books, study guides), recordings on cassettes (audio cassettes, video cassettes) or broadcasts (radio and television broadcasts).

Romiszowski (1988), defining media in general, points out that media function as the carriers of messages, from a transmitting source to the receiver of the message. The transmitting source he refers to is a human being or an object that functions as a teacher, while the receiver of the message is the learner or a group of learners. Gerlach and Ely (1971) give a broader definition: a medium is any person, material, or event that establishes conditions which enable the learner to acquire knowledge, skills and attitudes. According to this definition a medium could be a teacher, a text book, a recorded voice, etc. In each case, their function is to provide visual and auditory information that will help the learner to achieve a set of learning objectives. Gerlach and Ely (1971, p. 282) further specify media used for learning as 'the graphic, photographic, electronic, or mechanical means for arresting, processing, and reconstructing visual or verbal information'. They view media as things that help to accomplish certain functions that teachers alone cannot accomplish, or can accomplish less efficiently. For instance, media such as photographic pictures, motion pictures and audio tapes are used to capture and preserve events for later use.

2.21 Strengths of audio-visual media

Why do we need to store information in a medium and later reconstruct it for the learner? Why not show the actual event or object? Romiszowski (1988) discusses several instances when it is impossible to use an actual event or an object. One is when the actual things cannot be readily shown: 'either they are too large, too small, too expensive, too dirty, too dangerous, too delicate, or they only come out at night!'. Thus the teacher may have to turn to an alternative, such as a model or a picture. Another is when the characteristics to be shown are not obvious to the naked eye, such as inside the body of an animal or a plant. A third instance is when explaining concepts that are impossible to see in the real world, such as energy or light waves. In these situations, audio-visual media become more practical, and more meaningful to the student. Media are able to show things faster or slower than the normal speed, as when showing the opening of a flower bud or pole vaulting in slow motion. And they are able to show events and objects to large numbers of viewers regardless of geographical distance.

2.22 Limitations of audio-visual media

Laurillard (1993) carries out an analysis based on her 'conversational framework', which illustrates essential functions that both the teacher and the learner should perform for effective learning. Her analysis shows that the very strength of the audio-visual media seems to be their weakness, too. The function of audio-visual media is to help the teacher to convey his or her idea to the learner. However, audio-visual media are incapable of performing other necessary teaching functions. Students cannot describe to these media their understanding, or experiment with ideas in order to arrive at a better understanding. Taking video as an example, Laurillard (1995, p. 181) says: 'video is good at conveying the teacher's ideas, through words, pictures and events, and can even offer, if not direct, at least vicarious experience of the world. It can do nothing, itself, to enable the learners to express their own ideas'. Romiszowski (1988), too, points out that these media function only as one-way because they are incapable of dealing with any messages that the learner may want to send. Although these media can be used effectively, with appropriate planning, often the learning offered by these media is passive. The learner becomes an observer or listener. It is not possible to build many learning activities around these media alone.

Another limitation of audio-visual media arise from a cost point of view. Keegan (1990) and Romiszowski (1988) points out that it is more expensive to use media as a supplement to the teacher, therefore, they favoured the use of 'stand-alone media' – using media as stand-alone teaching and learning strategies. A third limitation is that in audio-visual media, the information is normally stored in a linear way – thus retrieval of information also is linear: it expects students to learn from the beginning to the end.

Media that use the processing and display capabilities of computers have now penetrated the field of education, promising to overcome these limitations. There is a range of terms to describe these new media; Mason (1994) uses the term 'interactive media'.

2.3 Interactive media

Within the broad term 'interactive media', two kinds are distinguishable, based on their function in a learning environment. The first kind consists of media that facilitate learners' personal interaction with textual information (Mason, 1994). Here, the learner(s) engage with learning material digitally processed and stored in a computerised system. Researchers and authors use two main terms to describe this kind: 'interactive multimedia' (Plowman, 1996; Latchem et al, 1993; Romiszowski, 1993; Reeves, 1993; Tan and Nguyen, 1993; Henderson, 1993; Ambron and Hooper, 1990) and 'multimedia' (Whalley, 1995; Laurillard, 1995). Some authors use both terms (Preece, 1993; Frylinck and Raitt, 1993). In a pedagogical analysis of media, Laurillard (1993) uses the term 'computer-based media', and identifies eight types: hypertext, multimedia resources, simulations, microworlds, modelling, tutorial programs, tutorial simulations and tutoring systems.

A second kind of interactive media facilitates person-to-person interaction (Mason, 1994). Mason uses the term 'communications media' while Laurillard uses the term 'teleconferencing media' to describe media used to support communication among learners and instructors who are geographically far apart. Audio conferencing, video conferencing, computer-mediated conferencing and audio-graphics come under this kind. Mason predicts that although these two kinds of media – 'computer-based media' and 'communications media' – are fairly distinct in their application and equipment requirements, the trend is towards their eventual merger into multimedia desktop conferencing. Today it is possible for an individual learner to use a computer-based medium such as a multimedia resource stored in a CD-ROM while discussing it with another learner using the technology of computer-conferencing. Also it is possible for geographically distributed individual learners to share information from multimedia resources displayed on their personal computers.

2.31 Interaction

Interaction appears to be the key word in discussions on new interactive media used for learning. In the literature, interaction is regarded as a vital factor in teaching and learning. Mason (1994) says that no other concept characterises so well the educational thinking in the 1990s.

Although interaction is in the forefront of discussions, the current situation suggests that it is a concept more talked about than practised. Livengood (1987) complains that interactivity has been 'the buzzword' since new interactive media were introduced for education and training. Others argue that the terms 'interaction' and 'interactivity' have not been well defined:

> One of the major difficulties surrounding discussions of interaction and interactivity is that these terms, while widely used, have not been clearly or functionally defined (Wagner, 1994, p. 6).

> While the term is freely bandied about, interactivity is an ill-defined concept, especially with respect to computers and its importance in instruction (Borsook and Higginbotham-Wheat, 1991, p. 12).

Interaction, being a hypothetical construct, may acquire a number of meanings, depending on the author and the context (Moore, 1989b; Looms, 1993; Thompson and

Jorgensen, 1989). Livengood (1987) suggests that designers and developers of instructional material based on computers and interactive video use the words 'interactive' and 'interactivity' without focusing on their meanings in teaching and learning. The result is '..a bandwagon effect such that every programme, every technology, every approach is labelled 'interactive' by some obscure definition of the word' (Mason, 1994, p.26). Therefore, an analysis of the term 'interaction' will be useful in understanding how interactive media support learning.

Dimensions of interaction

The individual learner is within a learning environment comprised of the other learners, the instructor, and various non-human resources used for learning such as books, television programmes, recorded audio and video, and interactive media. The learner interacts with these human and non-human components during learning. The learner may have either a face-to-face relationship with them, as in classroom situations, or a distance relationship, through a range of media.

These interactions or relationships have been referred to as types of interaction, and Moore (1989b) identifies three types:

- learner-content interaction
- learner-instructor interaction
- learner-learner interaction

Learner-content interaction is the interaction between the learner and the content or the subject of study. The process of intellectual engagement with content changes the learner's understanding and perspective. Moore explains that this type of interaction corresponds to Holmberg's (1986, cited by Moore, 1989b, p. 2) notion of 'internal didactic conversation' – learners talking to themselves about the information and ideas they encounter in a text, television program, or lecture. Learner-instructor interaction is the engagement between the learner and the instructor or the subject expert. Learner-learner interaction is the engagement between one learner and other learners, alone or in group settings, with or without an instructor present, at the same time or asynchronously.

Mason (1994), too mentions these three types of interactions, though she preferred the term 'dimensions'. She adds that the interaction between the student and the content may be via various media, such as text, a computer program, video or combinations of them. The interaction between the teacher and the student may be in the form of question and answer sessions after lectures, by telephone, fax or email, in office hours or in class. Lastly, the interaction between students may be in self-help groups, collaborative work projects, or in discussions and seminars.

Further analysis is required, however, to explain the relationships that may occur between different components that are involved in a learning situation. To what extent are these relationships or interactions similar? Is the interaction between learner and the tutor similar to the interaction between learner and the content? Learner-learner interaction is a human-to-human interaction. So is the learner-instructor interaction. Learner-content interaction seems to be different, because it is not a human-to-human interaction.

Content may take many material forms, such as books, television programmes, recorded audio and video programmes, computer programs, etc. These material forms could be classified as 'learning resources', and the learner's interaction with these may be classified as learner-learning resources interaction. Content also may be associated with other learners and the instructor. Therefore, the learners can interact with (a) human beings and/or (b) learning resources in order to interact with content. When the learner interacts with a book or a television programme or an interactive medium, the learner intellectually interacts with the content. Similarly, the objective of a learner's interaction with the instructor or the other learner is to interact with the content or the subject of study. The instructor and other learners are carriers of content.

Therefore, it is possible to list three dimensions of interactions, as illustrated in Fig. 2.1. These dimensions will be useful in constructing a model of interaction. Learners interact with the three components in order to interact with the content.

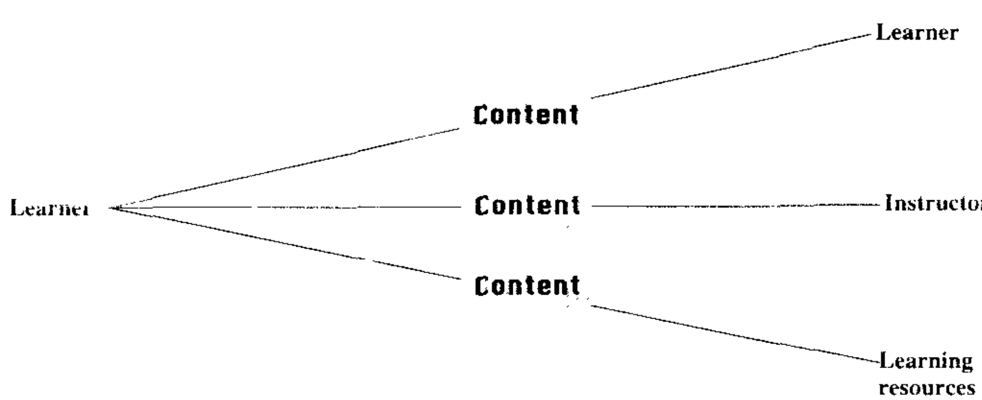

Fig. 2.1: Dimensions of interactions

These interactions may occur either face-to-face or through media. Fig. 2.2 represents the dimensions of both kinds of interaction. The learner-content interaction is the common factor.

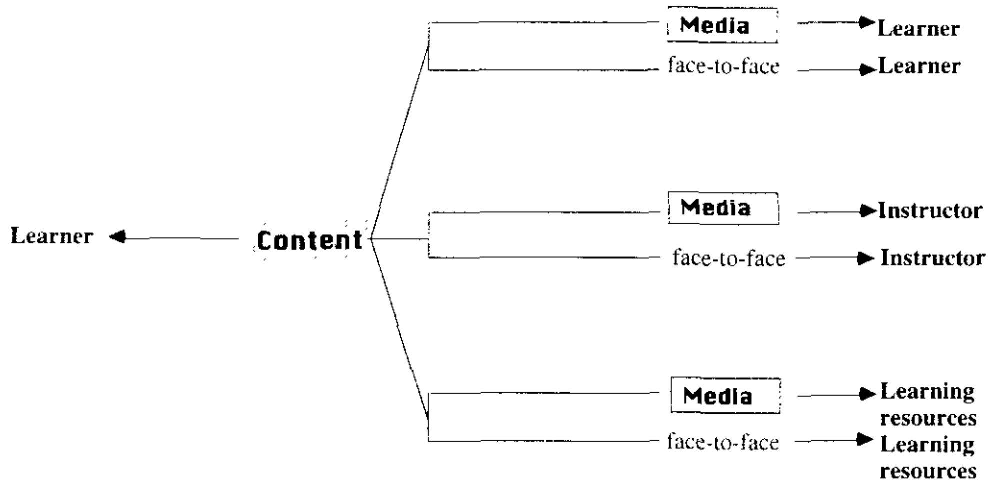

Fig. 2.2: Dimensions of interaction both face-to-face and through media

In the literature, views vary on how the interactions between the learner and the human components, and between the learner and learning resources, support learning.

Interaction between humans

As far as the human components of a learning environment are concerned, the interpersonal aspect of communication is highlighted as the key aspect of interaction. For instance, Simpson and Galbo (1986) see interaction as how the individuals and groups act upon each other. They argue that interaction is a wider concept, and characterised by a two-way relationship. They view interaction as continually emerging: 'communication in its most inclusive sense' (ibid., p. 38). Wagner (1994) holds a similar view: interactions are reciprocal events that require at least two objects and two actions. Interactions occur when these events mutually influence one another. Bååth (1979, cited by Hillman et al. 1994) also focuses on the two-way communication between the tutor and the student. Holmberg (1988, cited by Hillman et al, 1994) puts forward the notion of 'guided didactic conversation' for effective learning. These ideas on interaction focus mainly on the human-human dimension.

What about the nature of interaction when the technologies, especially the new interactive media, come into teaching and learning?

Interaction with interactive media

The 'Nebraska Scale', designed by the Nebraska Videodisc Design/Production Group (Looms, 1993, p.117; Fuller, 1987, p. 15), is a purely technical approach belonging to the early 1980s. This scale measures interactivity at three levels:

- Level One: a videodisc player with facilities designed to still/freeze frame, chapter stop, frame address and dual-channel audio;
- Level Two: a videodisc player with the capabilities of Level One, plus on-board programmable memory and improved access time;

- Level Three: Level One and Level Two players interfaced to an external computer and/or other peripheral devices, such as digital audio, touch screens.

The higher the level in the scale, the greater is the interactivity. But this scale takes into account only the capabilities of video players used for teaching and learning, such as their ability to show still and freeze frames, or provide instant access to different screens without having to play from beginning to end, their sophistication of interface such as use of touch screens, and the size of memory and processing capabilities of the computer. Reeves (1993) cites claims that such interactive technologies guarantee interaction in the learning process and therefore enhance learning. The first is by John Sculley of Apple Computers who asserts:

> Teachers and students will command a rich learning [multimedia] environment that, had you described it to me when I was in school, would have seemed entirely magical. Imagine a classroom with a window on all the world's knowledge. Imagine a teacher with the capability to bring to life any image, any sound, any event. Imagine a student with the power to visit any place on earth at any time in history. Imagine a screen that can display in vivid color the inner working of a cell, the birth and deaths of stars, the clashes of armies, and the triumphs of art. And then imagine that you have access to all of this and more by exerting little more effort than simply asking that it appear. It seems like magic even today. Yet the ability to provide this kind of learning environment is within our grasp (Sculley, 1988, p. vii, cited by Reeves, 1993, p. 79-80).

James E. Dezel of IBM is equally enthusiastic about the technology:

> Multimedia brings to bear dynamic visual information in the form of full-motion video that gives you a direct pipeline into the brain. We, as human beings, process that data very efficiently. The power of full-motion video combined with interactivity allows every person to discover knowledge in the patterns that fits their paradigm for learning – the way they learn best, individualised (Taylor, 1990, p. 27, cited by Reeves, 1993, p. 80).

These two statements strongly suggest that interactive media provide for interactive learning, thus enhancing learning. Many promotional materials use the words 'interactive media' and 'interactive learning' together. This kind of indiscriminate use of the word 'interactive' suggests that 'interactive learning media' automatically support 'interactive learning'. Reeves' (1993) view is that 'interactive media' cannot guarantee learning any more than a library. Weller (1988), commenting on learning material with the label 'interactive', says that too often what has actually been placed on disks and video discs as 'interactive' is actually less interactive than the print-based programmed instruction courses that were developed previously. Livengood (1987) also criticises instructional products labelled 'interactive' as little more than electronic workbooks employing techniques derived from programmed instruction, while other 'interactive programs' are simply show-cases for the high-tech capabilities of the systems they run on. He stresses the need to develop materials which use the capabilities of these sophisticated systems effectively.

Categories of interaction

Instructional interactions and systems interactivity

Understanding how the interaction supports learning and, more specifically, what aspect of interaction supports learning, seems to be a difficult task. Herring (1987, cited by Wagner, 1994) provides a useful distinction between two categories of interactions. He separates attributes of technological media, especially new communication technologies, from 'interactions' concerned with effective learning. Interactions that are the property of learning events he calls 'instructional interactions' while the delivery systems interactions, which are the property of media he calls 'systems interactivity'. Wagner argues that general discussions of interaction do not distinguish between these two categories:

> The growing 'folk' acceptance of a causal relationship between system interactivity and instructional interaction has placed an unrealistic expectation on interactive technologies to ensure that instructional interactions do occur (Wagner, 1994, p. 8).

Dillon and Gunawardena (1992) note that one reason for the tendency to equate the instructional interaction with system interactivity is the improvement of telecommunications and other technologies such as interactive video and interactive multimedia learning environments. These improvements have resulted in sophisticated machine-user interface options. For example, hypermedia are called 'interactive technology', because the user can point (either directly or indirectly) to reactive objects that are displayed on a computer screen. The pointing (carried out with touch screens, light pens, mouse, roller controllers, joysticks, or tracker balls) enables users to select the particular items of interest to them (Barker, 1993).

The distinction between instructional interaction and systems interactivity helps explain how interaction improves learning. Instructional interactions deal with learning activities that are central for effectiveness of learning. Systems interactivity, on the other hand, depends on the attributes of new technologies. The Nebraska scale (described before) clearly illustrates the attributes of interactive media, i.e., systems interactivity. If these attributes are used wisely, better instructional interactions could be made available to the learner. However, since the line between these two categories of interactions is at times invisible, only systems interactivity may be available to us. For instance, Livengood (1987, p.28) lists two items that cannot be considered as instructional interactions:

- the number of times a student presses a space bar or clicks the mouse
- the number of keystrokes per minute.

These activities are often available in interactive media, and they belong to the category of 'systems interactivity'. With only a click of the mouse or a key stroke, these media let the learner move around information structured in the computer system in different formats such as text, still pictures, moving pictures, and animations. Those physical operations alone are not directly responsible for effectiveness of learning, but enable the user to interact with the technology and the information structured in the computer. Thompson and Jorgensen (1989) also point out that common practice is to use the terms 'active' and 'interactive' to refer to simple physical manoeuvres to advance a computer program and to routine choices requiring only short term memory or simple manipulations of the material. These interactive attributes of the delivery system need to be used in association with interaction that is central to learning.

Fig. 2.3 locates the instructional interactions and systems interactivity within the three dimensions of interactions.

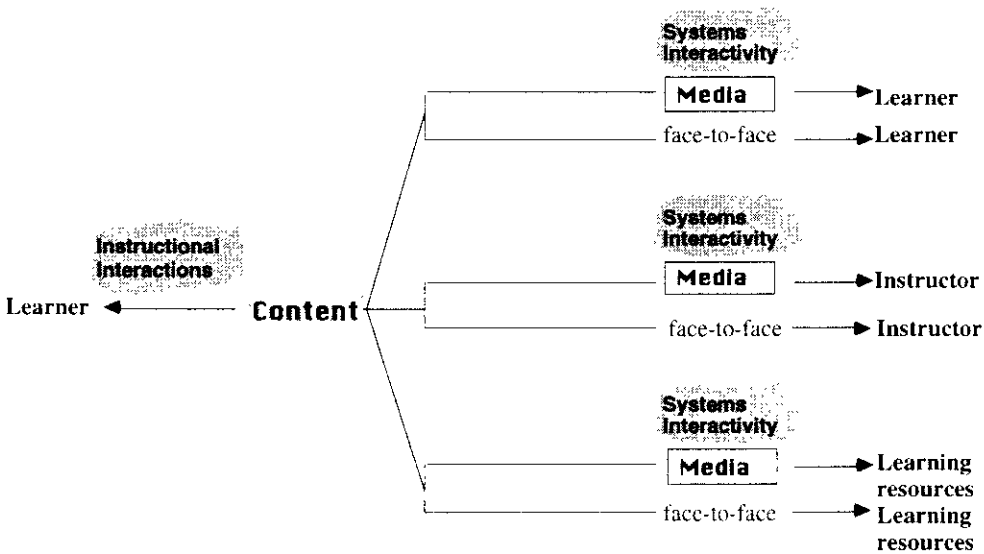

Fig. 2.3: The location of instructional interactions and systems interactivity within the dimensions of interactions

Learner-interface interaction

Hillman et al (1994), focusing on learning from interactive media, point out that it is important to consider the interaction that occurs between the learner and the technologies used to deliver instruction. Their argument is important in the light of new media used for learning. When the interactions occur through a technological medium, the learner has to deal with that medium too, according to Hillman et al. As technology increasingly becomes the means of communication for distance learning the design of the mediating technologies becomes correspondingly important:

> The greater use of these devices, as well as their increasing complexity, has led us to define an additional model of interaction – learner-interface interaction – in which the learner must interact with the technological medium in order to interact with the content, instructor, or other learners (Hillman et al, 1994, p. 33).

Where does the learner-interface interaction fit in?

When the learner interacts with a learning resource such as a book, the learner interacts with it without having to interact through an interface. Suppose the learning resource is a material based on a new learning technology, an interactive medium. Still the learner interacts with the resource, but has to interact with the interface of the program in order to interact with the content of the learning resource.

The learner-interface interaction becomes more distinct when the learner interacts with distant learning resources such as those courses delivered on the Web. The learner uses a personal computer linked to the Internet. He or she needs to interact with the interface in order to interact with the content on the Web. In computer-conferencing the remote learner needs to manipulate the interface in order to interact with the other learners or the instructor. The learner-interface interaction is a phenomenon that occurs within another dimension of interaction; it is a supporting or a mediating interaction.

A suggested model of interaction

My analysis of interaction can be summarised in Fig. 2.4 as a suggested model of interaction. This model consists of three dimensions of interactions and three categories of interactions.

The three dimensions of interactions are:

- learner-learner interaction
- learner-instructor interaction
- learner-learning resources interaction

The three categories of interactions that are important for learning within these dimensions are:

- instructional interactions
- systems interactivity
- learner-interface interaction

The model locates the three categories of interactions within the three dimensions of interactions.

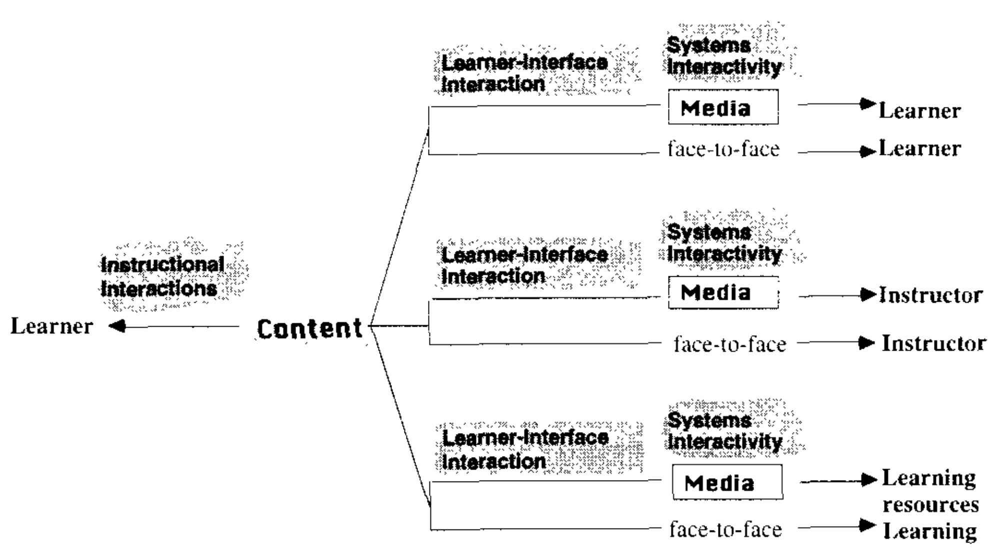

Fig. 2.4: A suggested model of interactions

When the learner interacts with either the other learners, the instructor, or the learning resources, s/he usually interacts with the content. The quality of instructional interaction is important on all three occasions. If learner-other learners and learner-instructor interactions are face-to-face, learning effectiveness is dependent very much on the interpersonal communication abilities of the parties at both ends. If this engagement is via a medium, the learner-interface interaction also becomes important, because the learner has to grapple with the technology too.

When the learner engages with a learning resource, say via a conventional medium such as a book, television programme, or audio cassette, the quality of instructional interaction built into the learning resource is important, because the learner is alone with the non-human learning material, learning alone. The learner-interface interaction is easy provided learner knows how to handle the technology. Systems interactivity is minor, compared with interactive media.

Now consider the case of the learner engaged with an interactive medium. The learning resource, or the learning material itself, is a new technology. The quality of learning depends on the quality of instructional interaction built into the learning material. It is supported by the high calibre interactive capabilities of the technology. Also the learning depends on how learner-interface interaction occurs – the learner's competence to handle the technicalities of the program.

Fig. 2.4 shows that instructional interactions occupy a prominent position in this suggested model of interaction, because they are central to learning. How can we characterise instructional interactions provided by interactive media?

Laurillard (1987a) expects interactive media to provide new ways of enabling students to 'interact with knowledge' and to explore and test the world they are trying to learn about, similar to the experience gained in a laboratory practical or a field investigation. This kind of interaction with knowledge offers a major challenge to education, where the traditional practice has been to emphasise transmission of knowledge rather than interaction with it. Thompson and Jorgensen (1989) point out that interaction should foster deeper understanding of the underlying principles and concepts. How can this be achieved?

The characteristics of instructional interactions can be summarised as follows:

- It provides feedback to the learner on his/her performance (Laurillard, 1993). Feedback is information that permits learners to judge the quality of their performance (Wagner, 1994). The quality of feedback is its most important aspect (Laurillard, 1987b) and this depends on the quality of the information and how the information is presented. Quality of information depends on its timeliness (when?), appropriateness (what?) and richness (how much?). Feedback requires two-way communication, another feature of interaction (Borsook and Higginbotham-Wheat, 1991).
- It may depend on the program's ability to (a) understand the learner's position (Livengood, 1979) and (b) adapt to the learner's level of knowledge

and pace of progress. It may involve strategies that facilitate non-sequential access to information and a range of options in the learning activity.

- It may give the learner greater control (Livengood, 1979; Johnson and Grover, 1993; Baynton, 1992; Friend and Cole, 1990; Kinzie and Sullivan, 1989). Other related concepts are independence, autonomy, and self-directed learning (Baynton, 1992). However, the concept of 'control' is more inclusive and is concerned with the opportunity and ability to influence, direct, and determine the decisions related to the educational process (Garrison and Baynton, 1987; Baynton, 1992). The three types of control that are important for learning are: control over learning strategy, sequence of learning and the content (Laurillard, 1987c).

Fig. 2.4 presents a suggested model of interaction based on my analysis of interaction. Although I outlined briefly the characteristics of instructional interactions, Laurillard's (1993) 'conversational framework' might be useful to comprehensively bring out and further illustrate the notion of instructional interactions.

Laurillard's conversational framework

Laurillard (1993) characterises the teaching and learning process as a dialogue between the teacher and the student. The teacher and student engage in this dialogue in order to arrive at an academic understanding of some aspect of the world, i.e., the student needs to be able to derive meaning from the learning experience and apply this knowledge to other problems. In academic learning students do not get the chance to get a direct experience of the world, or to carry out actions in the real world. For instance, students cannot learn about atoms by directly experiencing them. Rather they have to rely on others' descriptions of atoms. Therefore, the academic learning process, which is essentially a dialogue between the teacher and the student, is based on descriptions of the world. Laurillard identifies four functions that the teacher and student need to perform, for effective learning (Laurillard, 1993, p. 94-95):

<u>Discursive</u>

- teacher's and student's conceptions should each be accessible to the other
- teacher and student must agree learning goals for the topic, and task goal
- the teacher must provide an environment within which the student can act on, generate and receive feedback on descriptions appropriate to the topic goal

<u>Adaptive</u>

- the teacher has the responsibility to use the relationship between his or her own conception and the student's conception, to determine the focus of the continuing dialogue

<u>Interactive</u>

- the student must act to achieve the task goal

- the teacher must provide meaningful intrinsic feedback on the actions that relate to the nature of the task goal

Reflective

- the teacher must support the process in which a student links the feedback on his or her actions to the topic goal for every level of description within the topic structure

Laurillard elaborates these four essential functions into 12 activities, between the teacher and the student. These 12 activities constitute the 'conversational framework', illustrated by Fig. 2.5.

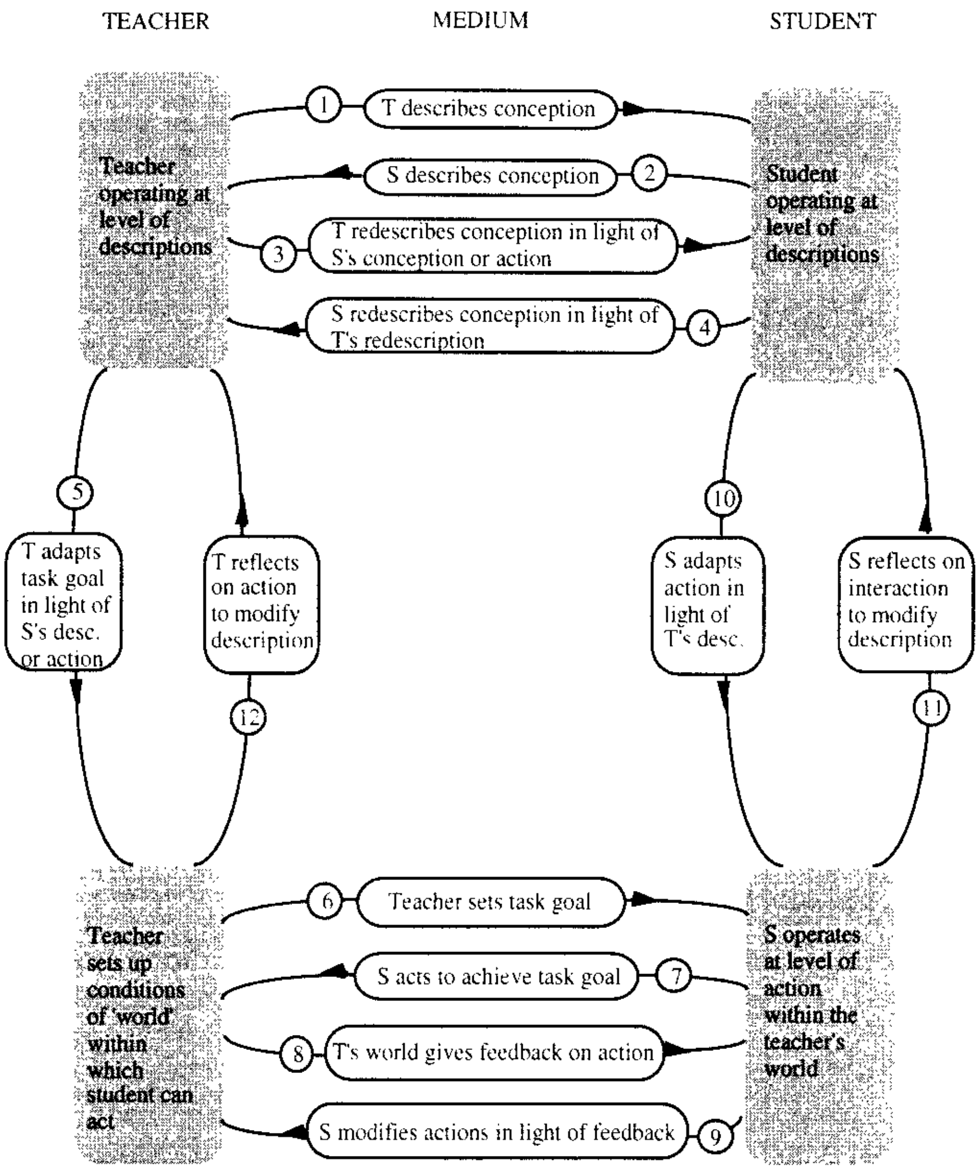

Fig. 2.5: The conversational framework (Laurillard, 1993, p. 103)

A learning activity that can fulfil the above four functions could be considered effective. To begin with, there should be a dialogue between the teacher and the student. In this dialogue the teacher and the student express their conceptions, aiming to understand each other's conception.

Based on the outcome of the discussion, the teacher adapts the learning task for the learner.

The third function, interaction, allows the student to experience the world. Because the student should be able to apply academic knowledge to new situations and new problems, the learning should go beyond mere experience; the student should be able to interpret it meaningfully. Teacher-constructed worlds with which the student needs to interact are, for example, a class room experiment, a field trip, a poem, depending on the subject matter (Laurillard, 1995). The teacher constructs the conditions of the learner's interaction so that the experience enables the learner to learn. On the basis of that particular experience the teacher can then begin to build general, abstracted descriptions.

The reflective function should be carried out by both the teacher and the student. The teacher reflects on the learner's performance and adapts what s/he says accordingly, as mentioned previously. This is to make teaching responsive to the learner's needs. The student uses what the teacher says to adapt his or her actions, and to reflect on the results of these actions in the teacher-constructed world, in order to modify and develop his or her own ideas, until both the teacher and the learner come to the same understanding.

Laurillard considers how various media can take the teacher's role and perform the above four functions. She points out that it is far easier to provide activities of the discursive function than the adaptive, interactive and reflective functions. Audio-visual media are capable of conveying the teacher's conception, but this is only one activity within the discursive stage. Since it is so easy to provide this function, interactive media too tend to follow suit.

Laurillard points out that enabling the learner to carry out activities in the interactive and reflective stages is crucial for improved learning. Therefore, instructional interaction should emphasise the activities in the interactive and reflective stages. Since the focus of this thesis is the farmers' interaction with computer-based media, I shall discuss how such media support these teaching and learning functions. The discussion will begin with an overview of computer-based media.

2.32 Computer-based media

Computer-based media have several advantages, both technologically and pedagogically, over traditional audio-visual media. As Latchem et al (1993, p. 19) say, such a medium '... combines all the processing power and control of the modern microcomputer with the motivational and presentational capacities of traditional audio-visual media'. Traditional audio-visual media are based on technologies of printing, recording and replay of audio and video, and broadcasting of radio and television. At their most sophisticated level, computer-based media can carry out most of the functions of traditional media, but often better and faster because they utilise the storage, processing and control power of computers to store and deliver information in various forms (text, graphics, audio, still images, animation, motion video, etc).

However, the greatest advantages of computer-based media are pedagogical. Computer-based media can shift the learner from a passive role to an active role. They can store and provide access to information in a non-linear way. Latchem et al claim that this is the real strength of computer-based media:

> ... the real strength ... lies ... in the courseware which provides browsable 'chunks' of information connected by predetermined 'links' and enables the end-user to access and navigate this information and build, test and apply knowledge in logical and personally meaningful ways (Latchem et al, 1993, p. 19).

The non-linear storage and accessing information is called 'hypertext', a concept that dates back little more than half a century. Barker (1993) documents how hypertext was first conceived and later implemented on computers.

Hypertext

The concept underlying hypertext was first conceived by Vennevar Bush in 1945 (Barker, 1993; Ambron and Hooper, 1990). Bush suggested a system called 'memex' in which individuals could store vast quantities of information, and create personal links between pieces of information. By using an indexing system individuals could retrieve information from this vast knowledge base (Bush, 1945, cited by Barker, 1993). Douglas Engelbart and Theodore Nelson extended this idea in the 1960s (Hooper, 1990). Engelbart developed the first hypertext system called 'Augment' (Barker, 1993, p. 20). Theodore Nelson was the first to introduce the term 'hypertext' in the late 1960s. He defined hypertext as being 'computer supported non-sequential writing' (Nelson, 1967). He envisioned an information universe, called 'Xanadu', containing all the world's literature interlinked in various ways, supporting multiple users and multiple applications (Barker, 1993, p. 21). Today's storage and processing technologies allow voluminous multimedia information, i.e., a combination of text, pictures and sound in 'hypertext' form, known as 'hypermedia' (Barker, 1993; Paine and McAra, 1993).

The key feature of hypertext, from the learners' point of view, is that the text has many nodes and links which allow the learners to determine their own routes through the material (Preece, 1993, p. 137). The author of a hypertext creates the document in a non-linear fashion, using 'nodes' to express concepts; these nodes are linked to each other based on the association the author believes exists between the nodes (Zhao, 1994). The author defines 'buttons' or 'hot spots' enabling him or her to define links between nodes (Paine and McAra, 1993). The text produced in such a way is a node-link network 'which cannot be printed conveniently on a conventional page' (Nelson, 1967, cited by Zhao, 1994, p. 6). In hypertext, the user navigates through the document by clicking on the 'buttons' or 'hotspots' defined by the author. Paine and McAra (1993) use the analogy of a series of file 'stacks' made of 'cards' to understand hypertext structure. As the user browses one card, ideas or links suggest themselves and other cards or stacks can be immediately accessed for this information. Fig. 2.6 is a simplified view of hypertext structure.

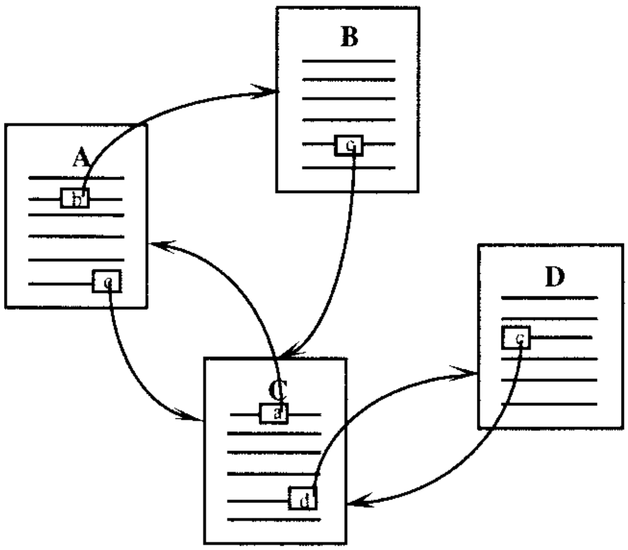

Fig. 2.6: A diagrammatic representation of hypertext structure (adapted from Zhao, 1994, p. 7)

In Fig. 2.6, A, B, C and D are the four documents that comprise the hypertext program. Document A has a hotspot 'b'; when clicked on 'b' the user can see the document B. Each document has at least one hot spot. There are six arrows showing links between documents.

Marchionini (1988, p. 9) highlights three ways in which hypertext contributes to learning and teaching: information storage and access, learner control and collaborative learning. First, hypertext systems allow large volumes of information to be stored in extremely compact form. This information can be in a variety of media and can be accessed easily and rapidly. Second, hypertext offers a high level of learner control. Learners are able to decide the pace and sequencing of navigation; they can jump from one piece of information to another, in any order, 'guided by intellectual curiosity or prior knowledge rather than any linear arrangement preordained by the product developer' (Paine and McAra, 1993, p. 41). Finally, hypertext provides users with the tools to alter or add to existing material. Learners in such an environment can create their own paths, save and annotate them as their own interpretations of the content, and share their notes with teachers and fellow students. In this way, hypertext 'blurs the distinction between the developer, the teacher and the learner' (Paine and McAra, 1993, p. 41).

While it is widely accepted that hypertext has the potential to offer a learning experience 'that would be difficult or impossible in any other medium' (Whalley, 1995, p. 190), there is a growing concern about whether hypertext is being used to its full potential, particularly in its multimedia form. Whalley states that multimedia must contribute something more to learning than 'simply point and click interactivity'. Laurillard (1995, p. 179) argues for a pedagogical analysis of what the new media systems can offer, an analysis that will impose on them a more ambitious objective than they currently have. Taking multimedia CD-ROMs as an example, she agrees that these programs make encyclopaedic data accessible to school children who get the opportunity to do their own 'research'. Children are more motivated to work with multimedia CD-ROMs than with printed encyclopaedia because it is fun. Though CD-ROMs provide faster information retrieval and greater learner control, Laurillard argues that the CD-ROM-based encyclopaedia provides information. Students need to transform this information into knowledge. CD-ROMs, in their information presentation form alone, cannot do that.

Types of computer-based media

Laurillard (1993) identifies eight types of computer-based media: hypertext, multimedia resources, simulations, microworlds, modelling, tutorial programs, tutorial simulations and tutoring systems.

The term 'hypertext' was used earlier to refer to the particular system used in all types of computer-based media to store and retrieve information non-linearly. The same term is used to describe a program produced in hypertext-style where the individual 'nodes' consist of only pages of text. As discussed previously, the nodes could consist of any: graphics, still photographs, audio, video and computer-generated animations. According to Laurillard, (1993, p. 127) 'the combination of a hypertext system with audio-visual media to give multimedia brings together the best of both'. Laurillard referred such media as 'multimedia resources'.

The ability to provide easy and fast access to information of the learner's choice is highlighted as the real strength of both hypertext and multimedia resources (Laurillard, 1993). The authoring programs used to create both these media support various facilities such as indexing, referencing, searching and editing. Moving around the large database to access and display an item of information is easy through mouse clicks and pull-down menus.

However, neither hypertext nor multimedia resources support a majority of the functions of the teaching and learning process (Laurillard, 1993). Accessing a hypertext or a multimedia information base is not interactive, because the information in the database does not change as a result of the users' actions. Laurillard points out that 'it is no more interactive than writing in the margins of a book, or editing the book yourself, or annotating it with your own reference to another point in the book. It would not be possible for the student to tell if they had made an inappropriate link – the system remains neutral with respect to anything they do' (p. 121). The students may type their own 'documents' and make their annotations, but that is exactly what they do when they annotate text books. By doing such an activity, the students carry out an important aspect of the learning process, the description of their own conception. However, 'hypertext does not provide anything more than wide margins' – in hypertext, documents entered by students can be any size (p. 125).

Neither media offers feedback on students' description, so are not fully discursive. Neither do they offer action on the world or a simulated world. The only action offered is the manipulation of descriptions: the text available in the system can be annotated, interlinked, and edited. However there is no feedback from the system on what learners do. Laurillard concluded that 'the case for hypertext (and multimedia resources) as an innovative pedagogical medium is confined to its limited discursive (see below) capabilities'; 'its logistical advantages are clear for information retrieval, however' (p. 125). Laurillard concluded that a simple hypertext system can be neither adaptive nor reflective.

Laurillard's (1993, p. 177) media comparison chart, Table 2.1, shows how the various computer-based media support the functions in the teaching and learning process.

Table 2.1: Media comparison chart (from Laurillard, 1993, p. 177)

Functions in the teaching and learning process	Activities between the teacher and student	Hypertext	Multimedia resources	Simulation	Microworld	Modelling	Tutorial program	Tutoring system	Tutorial simulation
Discursive	1 T describes conception	√	√	-	-	-	√	√	√
	2 S describes conception	√	√	-	√	√	√	√	√
	3 T redescribes conception in light of S's conception or action	-	-	-	-	-	√	√	√
	4 S redescribes conception in light T's redescription	√	√	-	-	-	√	√	√
Adaptive	5 T adapts task goal in light of S's description or action	-	-	-	-	-	√	√	√
Interactive	6 T sets task goal	-	-	√	√	√	√	√	√
	7 S acts to achieve task goal	-	√	√	√	√	√	√	√
	8 T's world gives feedback on action	-	√	√	√	√	-	√	√
	9 S modifies actions in light of feedback	-	√	√	√	√	-	√	√
Adaptive	10 S adapts action in light of T's description	-	-	-	√	√	√	√	√
Reflective	11 S reflects on interaction to modify description	-	√	-	√	√	-	√	√
	12 T reflects on action to modify description	-	-	-	-	-	-	√	√

Table 2.1 shows that simulations can carry activities listed under the interactive function. Simulations allow learners to carry out actions in a simulated world that provides feedback for their actions, a significant improvement on basic hypertext. The learner can gain a particular kind of experience through a simulation. A limitation of simulations, however, is that they cannot make any decisions about the students' level of understanding on the basis of their actions, and cannot make new suggestions. Students may come to the wrong conclusion based on the feedback. Simulations can only give feedback in the form of changing a figure or a shape of a graph, based on the model built into the program. They cannot comment on the student's action, so simulations are not discursive. Table 2.1 shows that they fail to address discursive, adaptive and reflective functions.

Table 2.1 shows that, as we move along the spectrum of other types of computer-based media, more and more functions of the teaching and learning process are provided. For instance, microworlds provide feedback which is more descriptive, because the student can use a programming language to interact with a microworld. The use of a programming language allows the learner to act in the simulated world in a more descriptive way. This descriptive action can be used for further analysis by the learner and facilitate reflection and revision. The feedback given by the program is more meaningful to the learner. Other computer-based media – modelling, tutorial programs, tutorial simulations, and tutorial systems – provide more functions of the teaching and the learning process.

The above comparison shows the variety of learning experiences that computer-based media can provide. With adequate design and support, these media can be used to provide learning opportunities for farmers. These media can solve logistical problems by enabling farmers to learn at their own homes or offices and at a time and pace they choose. In addition to providing solutions to logistical problems, however, what kind of pedagogical problems can these media solve?

2.4 The research problem

Chapter 1 examined the dilemma of the UK farmer: how to make profits under (a) a growing pressure from the public about the effect of farming activities on the environment, health, conservation, animal welfare, food safety and the rural economy and (b) the regulations imposed by EEC and the government to preventing surplus production. Chapter 1 also identified three kinds of training need that arise from this situation, and argued that farmers need to be trained in order to farm profitably. What media are capable of meeting these training needs?

First, farmers need to be constantly updated regarding the debate about farming, the environment and the countryside. This need can be met by receiving information about the current situation. Audio-visual media are suitable for this, according to the media analysis carried out. Currently, magazines such as 'Farming Weekly', radio programmes such as 'Farming Today' and 'On Your Farm', and television programmes such as 'The Countryfile' are dedicated to this.

The need for training in how to comply with health, safety and environmental regulations, goes beyond just receiving information. It requires farmers to get hands-on experience and improve their practical skills. Chapter 1 discussed the current face-to-face methods used in this regard and pointed out their limitations. Looking at the characteristics of distance learning, Chapter 2 points out how distance learning can help farmers to meet their training needs, by overcoming their logistical problems. There have been a few attempts at reaching UK farmers with distance learning, most based on traditional audio-visual media. Computer-based media seem to be more suitable, because they can not only overcome the logistical problems but also provide more effective learning. However, audio-visual media such as television and video programmes can be effectively used for imparting practical skills.

The third training need is that farmers must acquire the knowledge and skills needed to farm profitably under current conditions, while responding to the demands of the general public and observing the regulations. This training need, seemingly the most important one, goes beyond receiving information and acquiring practical skills. Farmers need to be able to evaluate how their farm management decisions affect not only their financial profitability, but also the environment and the economy surrounding their farms. They need to take account of public opinion and the regulations imposed upon them. This means that they need to have a deep understanding of the variety of factors involved in present-day farming. Audio-visual media cannot deliver such training because it involves more than just sending and receiving information. This training need is difficult to meet through face-to-face training, too, because of the complexity, time and cost involved. For example, a training organiser's view was that:

> ... in the industry they (the farmers) are in, they can't afford to make a mistake, because it is over a long time. If you have decided to put in a new building, and you make the wrong mistake for whatever reason, you are looking at having to alter that after five to ten years (Mason, 1995).

In the real world, it may not be possible to see the effects of one particular farm management decision over a short time. Computer-based media such as simulations can help farmers make decisions in a simulated world and gain a deep understanding about how to make profitable farm management decisions that take into account the opinions of the general public and regulations. Therefore, the third training need falls within the capabilities of computer-based media.

To summarise the research problem:

The research problem is to examine how a selected interactive computer-based medium enables farmers to gain a deep understanding of the interplay of various factors involved in present-day farming and make profitable farm management decisions, while observing regulations and taking into account public opinions.

The Countryside Disc, a simulation on a computer-controlled videodisc, is the selected medium for this study, which investigates the instructional interactions, as identified in this Chapter, of the farmers who use it. Therefore this is one aspect of the investigation. The other aspect of the investigation is the learner-interface interaction, because that too influences how farmers learn from computer-based media. Fig. 2.7 illustrates the focus of the study.

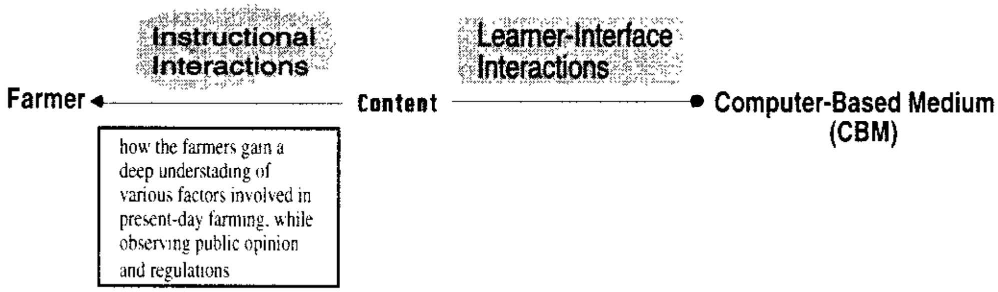

Fig. 2.7: Focus of the study (adapted from Edirisingha, 1996, p. 316)

2.5 Conclusions

This chapter reviewed the literature for the study in order to refine the research problem. It highlighted the characteristics of distance learning and discussed attempts to provide distance learning for UK farmers. It critically examined audio-visual media used in distance learning and pointed out their limitations. It then discussed interactive media and defined fully the concept of interaction, illuminated by a model that relates the various categories and dimensions within the concept. Later it discussed various types of interactive media and the specific computer-based media used for the research. Finally, it stated the research problem. The next chapter will describe the program used for this study.

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Chapter 3
The program

This chapter describes the program used for the study and explains how the choice was made. First, it presents the criteria for selecting a suitable program. It then describes and compares three programs that were considered for their suitability. Finally, the chapter gives a detailed account of the program selected for the study.

3.1 Criteria for selection

The program selected for the study should suit the investigation undertaken. Chapter 2 stated the specific research problem as examining how a selected computer-based medium can fulfil the specific farmer training need – enabling farmers to gain a deep understanding of various factors involved in present-day farming and to make profitable farm management decisions, while observing public opinions and regulations. The program should address this training need, and by using the program farmers should be able to experience how their farm management decisions affect not only their financial profitability, but also the environmental and rural economic aspects.

Laurillard (1993) suggested that the four essential functions of teaching and learning process that media should perform are: discursive, interactive, adaptive and reflective. She points out that it is more important to facilitate the interactive, adaptive and reflective functions than the discursive function. The interactive function allows the learner to carry out activities in the world, or a simulated world, and see the results for himself or herself. During the adaptive function the program evaluates the learner's performance and adapts the teaching accordingly. The learner also adapts his or her actions, and in the reflective function, he or she reflects on the results in order to modify and develop his or her understanding. According to the research problem, the program should enable farmers to carry out actions and see the results for themselves. Therefore, the program selected should be able to perform the interactive function of the learning process.

One type of computer-based program that can provide the interactive function is simulations. A simulation is 'a program that embodies some model of an aspect of the world, allows the user to make inputs to the model, runs the model and displays the results' (Laurillard, 1993, p. 130). The program displays feedback to the user in the form of textual descriptions, pictures, sounds, numerical values or combinations of these, in response to inputs. However, simulations only respond via the model built into them. They are interactive in the sense that the system gives feedback on student's actions, but does not comment on, or discuss them, so is not discursive. Simulations fail to address interaction at the level of descriptions, adaptivity of task focus, and reflection (Laurillard, 1993). Despite these weak points, simulations enable users to carry out activities in a simulated world and receive feedback. Therefore, I decided that the program used for the study should include a simulation.

3.2 Available programs

Three simulation programs, the only ones available for farmers, were considered for their suitability: Nitrogen Cycle (Nicol and Heath, 1994), Beet (Nicol and Heath, 1994), and The Countryside Disc (Marchant, 1988).

The first two programs are PC-based running Windows 3.1. The Nitrogen Cycle models the nitrogen cycle; it shows the various relationships that govern the flow of nitrogen in a farming system (Nicol, 1995). The user inputs the level of nitrogen into the program which calculates the transformation of this nitrogen into various forms. It shows the output of the cycle in figures and graphs. The second program, Beet, is a pest management simulation for sugar beet where users manage a farm of 120 ha. (Mumford and Miller, 1995). The documentation advises that Beet is best used with competing teams of students. The players are assessed by how much profit they earn and whether they use hazardous chemicals.

The Countryside Disc is an interactive videodisc produced by the BBC's Interactive Television Unit (Marchant, 1988). It has three main parts. On Side 1 is a simulation of an English farm that the farmer is asked to manage. He or she can explore nearly three hundred hectares of farmland and make decisions as to which crops should be grown on the 47 fields. Controlling the livestock, the amount of farm machinery, and the personnel required to operate the farm profitably are other tasks for the farmer. The second part, on Side 2, consists of two filmed case studies looking at arable and upland farming and six essays appended to each film that are accessed using hypertext. The third part, also on Side 2, is a massive database that includes population and agricultural censuses, biological records, and soil surveys that can be displayed as maps or charts. The first part, the simulation, was considered for the study.

An ATB training organiser and an agriculture college lecturer reviewed these programs for me and supported my choice: the Countryside Disc seemed to be the best because it met the training need, and because of feedback it provides. It also includes a multimedia resource.

3.21 The training need

The Countryside Disc is the only program that covered the particular training need extensively, compared with Nitrogen Cycle and Beet. The program 'allows you to explore some of the issues facing the countryside today. .... Users will have to consider many issues relating to agriculture, the environment and to the rural community (Atkins et al, 1988, p. 1). It enables the users to gain an insight into the complex relationship between agriculture, the environment and the rural community. The program was useful for farmers, as one farmer reflected after using the program:

> '... it was very topical. .... you weren't trying to maximise profits; there was the environment side of it, and the social side of it as well, how [these two aspects] integrate with getting an optimum for the farm (Thomas, 1996).

As section 3 of this Chapter shows, this program requires farmers to make management decisions, while considering how these decisions affect the environment and the rural economy. Therefore, the Countryside Disc was considered suitable.

3.22 The nature of the feedback

The nature of the feedback provided by the Countryside Disc is better for learning than the feedback from Nitrogen Cycle and Beet. The feedback from Nitrogen Cycle is displayed as graphs and figures, whereas the feedback from the Countryside Disc is both in the form of short videoclips that comment on farmers' actions, and changes in figures. At a basic level, the feedback given by Nitrogen Cycle and Beet fulfils the requirement for a simulation: the learner makes inputs to the model and the program displays results according to the model. However, this type of feedback is not adequate for learning (Laurillard, 1993). Manipulating the parameters of a simulation – controlling inputs and seeing the resulting outputs as changing figures – does not allow the learners to understand why those changes occur. A learner may come to a wrong conclusion about the results. Laurillard concludes that ' ... the students' work is too close to the scientist's: their goal is to offer a description of [the topic under study], but they receive no feedback from the simulation program on how good their description is'(p. 92). Such feedback is 'good enough for science but not for learning' (p. 93).

Compared with these two programs, the Countryside Disc provides feedback that is richer and more detailed. As the next section shows, the user gets two kinds of feedback: on-going feedback while making inputs to the program and feedback after making all the inputs and running the model. The feedback consists of changes in figures and comments in the form of videoclips. Therefore, the Countryside is considered to be a better program.

3.23 A multimedia resource

Both Nitrogen Cycle and Beet are text-based with colour graphics, consisting only of a simulation. In contrast, the Countryside Disc consists of two kinds of media: a multimedia resource and a simulation. There are three main sections in the program: the Walk, the Office and the Plan. The Plan is the simulation. The Walk, the Office and some links in the Plan provide information to the learner, and are a 'multimedia resource' as defined by Laurillard (1993). Therefore, I considered that the Countryside Disc is best suited for the study.

3.3 The Countryside Disc

After the titles, the program shows the main menu, as in Fig. 3.1. It shows the three main parts of the program: the Simulation, the Case Studies and the Data. Only the Simulation was used for the study. Although the program developers labelled the whole section as 'Simulation', it consists of two types of computer-based media, as previously mentioned: a multimedia resource and a simulation.

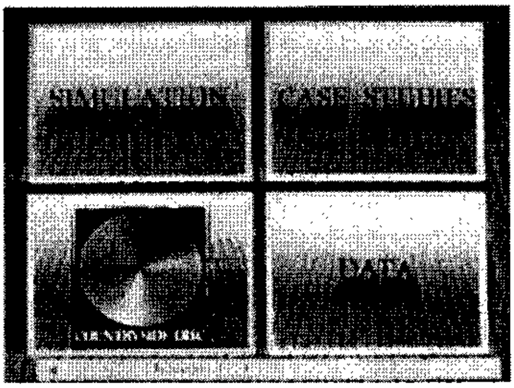

Fig. 3.1: Main menu

The program depicts an English farm, of about 300 hectares, and enables you to gain insights into the complex relationships between agriculture, the environment and the rural economy.

The program can be operated using either a keyboard or a trackerball. In this study, the trackerball was used. Users interact with the system by moving the pointer on the screen to a reactive object, and pressing one of the two buttons in the trackerball device: 'action' or 'change'. Except in the Plan, you press the 'action' button to access information. In this description, which I have written as if the reader were the user, the process of 'pointing and pressing the action button' is referred to as 'selecting'.

To start the program you select Simulation (move the pointer on the screen to the word Simulation and press 'action' button). The presenter introduces the program and explains the learning task. He briefly outlines the three main sections of the program – the Walk, the Office and the Plan. The introduction ends with a frame (Fig. 3.2) showing the bottom menu bar with five clickable words: 'Info', 'Walk', 'Office' and 'Plan' (Fig. 3.3). The presenter asks you to select either the 'Walk', the 'Office' or the 'Plan' from the menu bar.

Fig. 3.2: The last frame of the introduction section

◀	**Info**	**Menu**	**Walk**	**Office**	**Plan**

Fig. 3.3: Menu bar of the last frame of the introduction

3.31 The Walk

By selecting 'Walk' you go to the Walk section of the program (Fig. 3.4) where you can 'ramble' to any point of the farm or in the nearby village. At any point it is possible to see a complete panorama and to get a description of the point together with a list of the plant and animal species present. It is possible to look at pictures of each of these plant and animal species together with a text description.

Fig. 3.4: The Walk

The typical Walk screen consists of a 'compass' or direction indicator at the top left of the screen, a group of arrows at the bottom left corner of the screen and a menu bar at the bottom of the screen. The Walk gives you the opportunity to explore the whole area. There are three ways to navigate within the Walk:

Arrows

By selecting 'arrows' you move towards that direction. Fig. 3.4 shows four arrows on the screen. These arrows show different directions you can walk in from a particular location. The number of arrows varies from 1 to 10 depending on the number of directions in which you can walk. There may be only one or two arrows as you move towards the borders of the farm.

Selecting the side of the screen

By selecting left or right of the screen you look left or right of the screen, 45 degrees at a time. You can select the same side of the screen and look around the farm 360 degrees, the panoramic view of the farm. After eight selections you will be looking in the same direction. The 'compass' or direction indicator shows the particular direction you are looking at any particular time. Fig. 3.4 shows that you are looking at the east, because the direction indicator is turned eastwards.

Menu bar

Fig. 3.5 shows the menu bar that contains five clickable words:

◀	**Info**	**Menu**	**Options**	**Office**	**Plan**

Fig. 3.5: Menu bar of the Walk screen

'Info' and 'Menu' are available throughout the three sections – the Walk, the Office and the Plan –, and they provide the same functions in all three. Info gives access to the following:

Help: gives a text page explaining how to use the Walk (Fig. 3.6); when Help is selected, the menu bar changes.

Return: takes you back to the normal menu bar after reading Help and/or viewing Guide, and

Guide: the presenter explains how to use the Walk and what you can do within the Walk (Fig. 3.7).

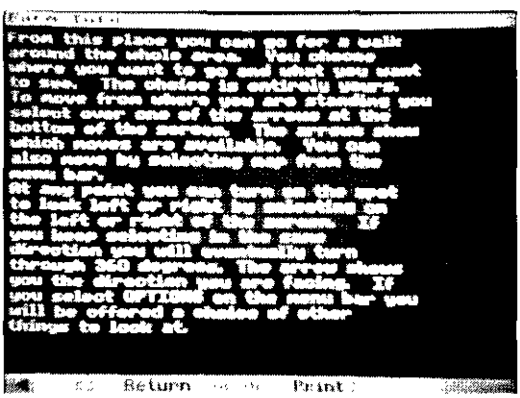

Fig. 3.6: Help for the Walk

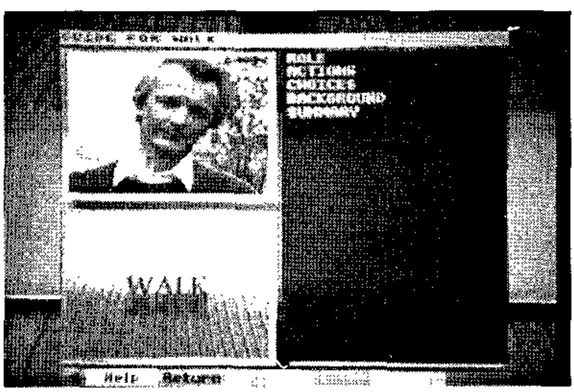

Fig. 3.7: Guide for the Walk

'Menu' takes you back to the main Menu (Fig. 3.1). You go to the Office and the Plan directly by selecting them. You go into more details of the Walk by selecting 'Options', which changes the menu bar to show more words (Fig. 3.8).

◄	**Info**	**Map**	**Description**	**Options**	**Office**	**Plan**

Fig. 3.8: The menu bar after selecting Options

'Info' gives you access to Help and Guide which I described before. 'Map' shows a map of the farm (Fig. 3.9); 'Description', a location description (Fig. 3.10), 'Plants', a list of plants (Fig. 3.11); and 'Animals', a list of animals (Fig. 3.12).

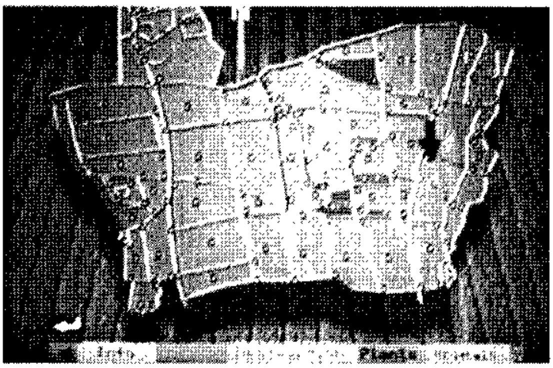

Fig. 3.9: The map

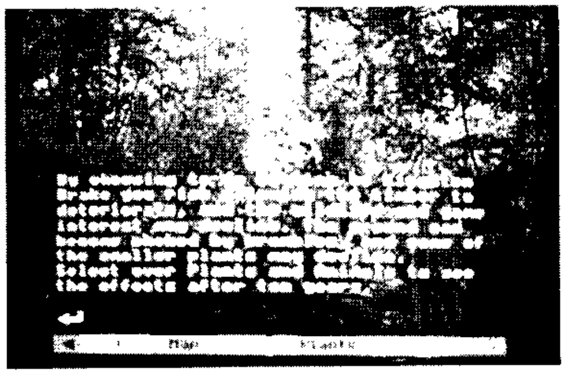

Fig. 3.10: A location description

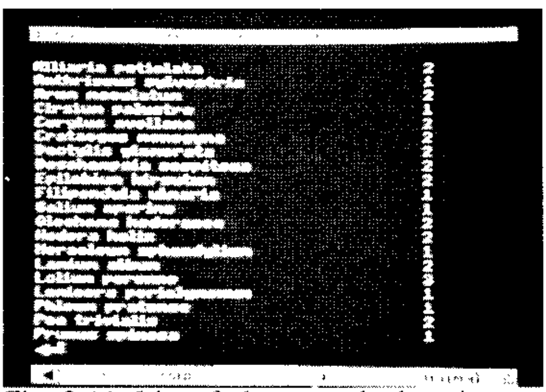

Fig. 3.11: List of plants on the location

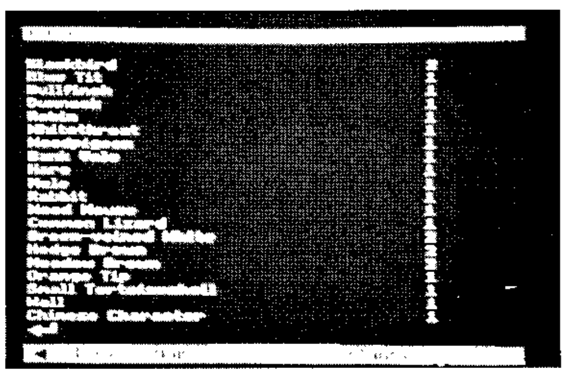

Fig. 3.12: List of animals on the location

By selecting a line you can view a photograph of the particular plant and animal species chosen (Figs. 3.13 and 3.14 respectively).

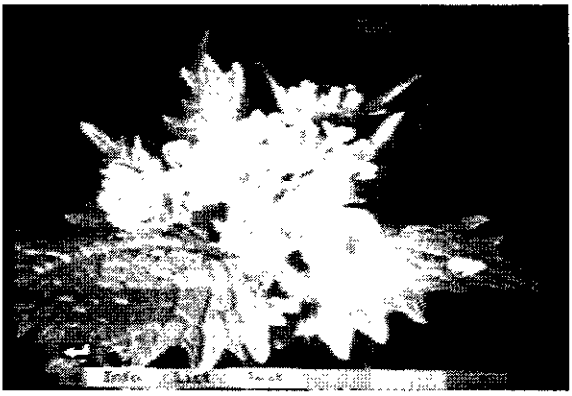

Fig. 3.13: Photographs of a selected plant species

Fig. 3.14: Photograph of a selected animal species

It is also possible to read a description for the selected plant and animal species (Figs. 3.15 and 3.16) by selecting 'Text' from the menu bar.

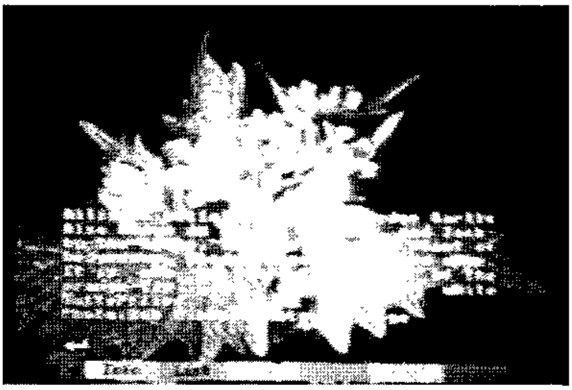

Fig. 3.15: Description of the selected plant species

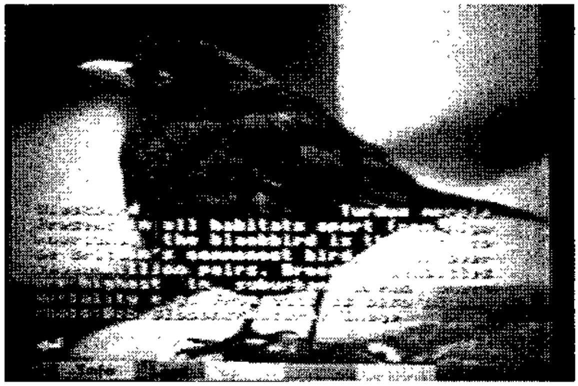

Fig. 3.16: Description of a selected animal species

You move from point to point on the farm using the arrows on the screen or using the map. While walking you can make notes (on paper) if you wish about each area of the farm. This information gathering is necessary for the final task because knowledge of the farm and its surroundings is helpful in drawing up an appropriate plan for the future.

3.32 The Office

The Office is the part of the program where you obtain more information about the farm, the environment and the rural community before drawing up your own plan. You access the Office by selecting the word 'Office' on the bottom menu bar. The Office is a photographic representation of a farm office with a 'television' , a 'video cassette recorder', a stack of 'files' and a 'computer' (Fig. 3.17). Also there is a 'map' of the farm on the wall and a 'window' overlooking the farm.

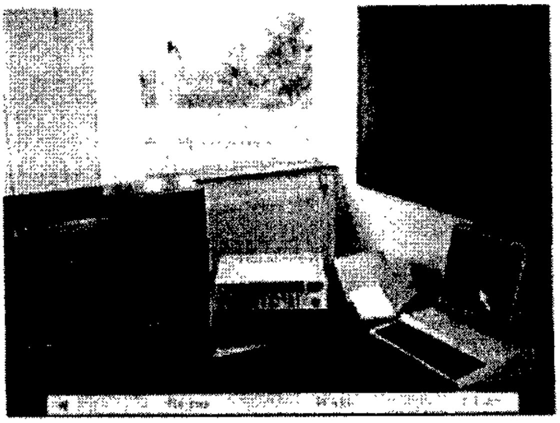

Fig. 3.17: The Office

Fig. 3.18 shows the menu bar of the Office with four clickable words:

◀	Info	Menu		Walk		Plan

Fig. 3.18: The menu bar in the Office

Info gives access to the following three options, much as before with the Walk:

Help: gives a text explaining how to use the Office (Fig. 3.19); when Help is selected, the menu bar changes.

Return: takes you back to the normal menu bar, after reading Help and/or viewing Guide, and

Guide: the presenter explains how to use the Office and what the user can do within the Office (Fig. 3.20).

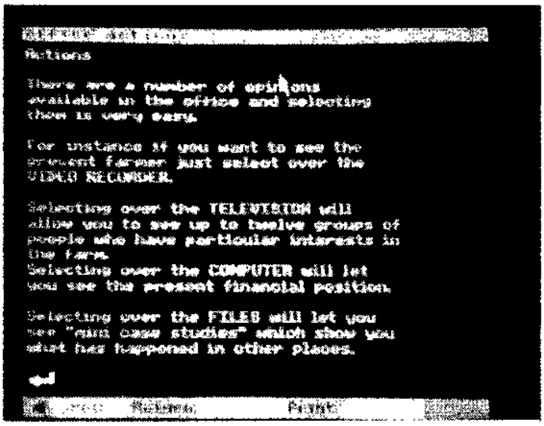

Fig. 3.19: Help for the Office

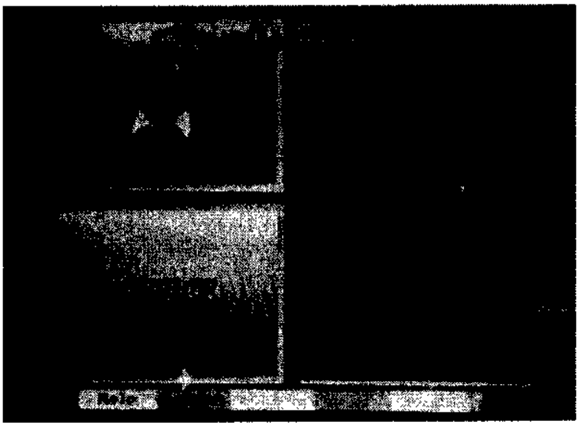

Fig. 3.20: Guide for the Office

'Menu' takes you back to the main menu (Fig. 3.1); 'Walk', to the Walk (Fig. 3.4) and 'Plan', to the Plan (Fig. 3.33).

Window

The 'window' too, will take you directly to the Walk, even if you hesitate to climb out through it!

The Map

The 'map' gives you the option of getting the Map in the Walk (Fig. 3.9), directly from the Office.

Television

You meet the interest groups through the 'television'. By selecting the television set you are offered 12 interest groups (Fig. 3.21):

Nature Conservancy Council
Countryside Commission
Rural Development Commission
District Council
Ministry of Agriculture, Fisheries and Food (MAFF)
National Farmers' Union
Enterprise Consultant
Naturalist/Rambler
Wildlife Advisor
Parish Council
Trade Union
Local

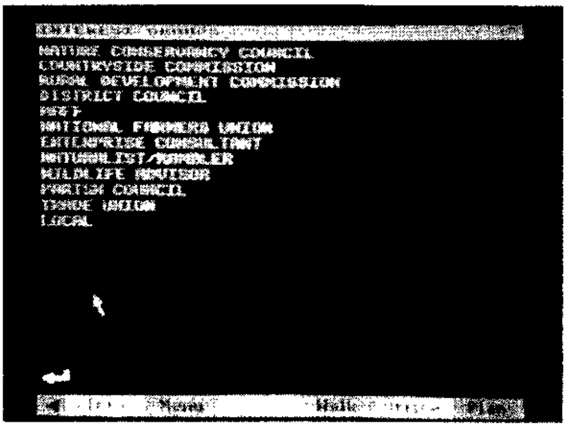

Fig. 3.21: List of interest groups

You can view a short (1 - 2 minutes) videoclip of the spokesperson for the interest group selected, who gives his or her opinion about how the farm should be managed (Fig. 3.22). You are free to take their opinions into account, or not, when making your own plans.

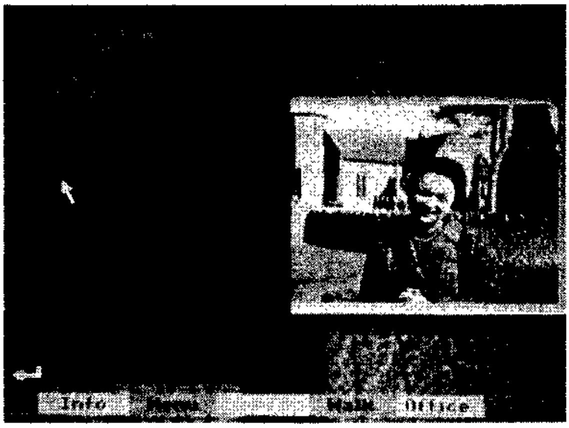

Fig. 3.22: Spokesperson of an Interest group

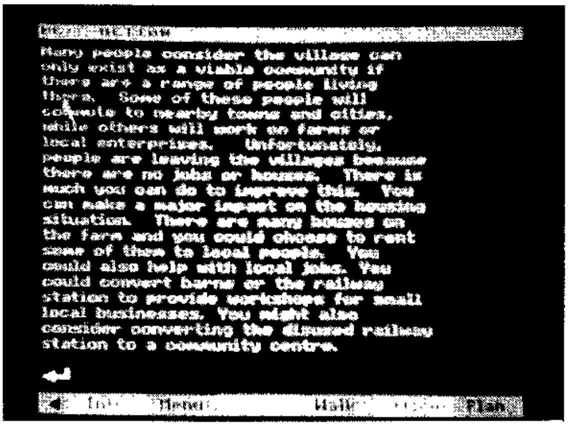

Fig. 3.23: Text explaining further what the spokesperson says

The screen beside the spokesperson includes five clickable words:

Introduction
Background
Policy
Choices
Summary

If one of these items is selected, the video will stop and a page of text will appear which gives details about the particular topic selected (Fig. 3.23). The text is different for each of the interest groups. You can select the return arrow at the bottom left to move back one stage. While looking at text, this takes you to the video. While or after looking at the film it takes you to the list of interest groups; and while looking at the list of interest groups, to the Office. If you want to go directly to the Office, just select 'Office' from the menu bar.

Video Cassette Recorder (VCR)

The VCR shows a short videoclip of the present farmer, Poul Christensen, who gives background information about the farm (Fig. 3.24). He explains how he manages the farm and what he has done to get it into its current state. Also he explains his attitudes towards the non-agricultural parts of the farm – the wildlife and the rural economy. He also talks about how agricultural policy has changed. By listening to Poul Christensen you can understand how the farm is managed currently, before making any decisions.

Fig. 3.24: The farmer

Mini Case Studies

Before taking certain actions on the farm, you may want to know more about those actions, specially what the consequences will be. Mini Case Studies contain information about some of the actions carried out on this farm and other areas (Fig. 3.25). You find out about them by accessing the case study list: select 'files' in the Office. To access each case study you need to select one from the list (Fig. 3.26).

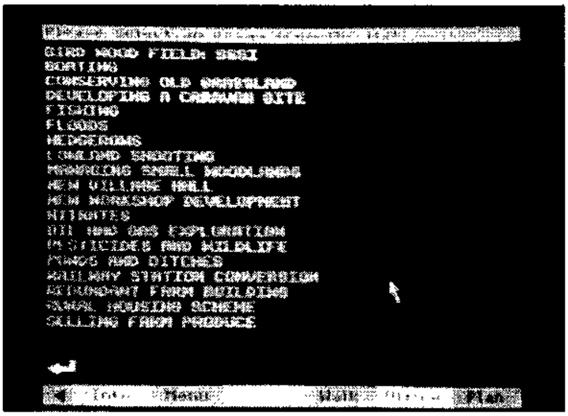

Fig. 3.25: List of Mini Case Studies

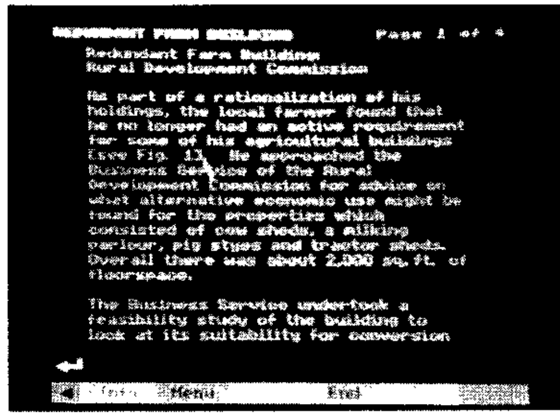

Fig. 3.26: First page of a Case Study

Each case study is an essay of a few pages. The top message bar of the screen shows the title, the current page number and the total number of pages (Fig. 3.26). To read the next page of the essay, point to the right side of the screen and press the 'change' button on the tracker ball. To go back a page, you point to the left of the essay and press the 'change' button. The 'First' and 'End' on the menu bar take you to the first page and the last page of the essay respectively. By selecting the return arrow at the bottom left-hand of the screen, you can exit from the essay and return to the list of Mini Case Studies. From there it is possible to select another essay or, by selecting the arrow again, you can go back to the Office.

Some information within the essay is illustrated by photographs, indicated by '[see Fig. x]'. By selecting anywhere between the square brackets, you can get a photograph (Fig. 3.27).

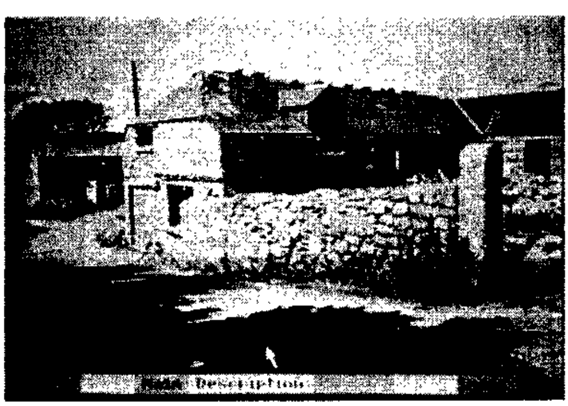

Fig. 3.27: A photograph accessed within a Mini Case Study

The menu bar gives additional options (Fig. 3.28).

◀		**Main**	**Description**			**Index**

Fig. 3.28: Menu bar of the screen showing a photograph

'Description' gives a description of what the photograph is about (Fig. 3.29) and 'Index' gives a list of all the photographs available for that essay (Fig. 3.30). You can look through all the photographs directly by selecting each line of the index in turn. After the pictures, go back to the main essay by selecting 'Main'.

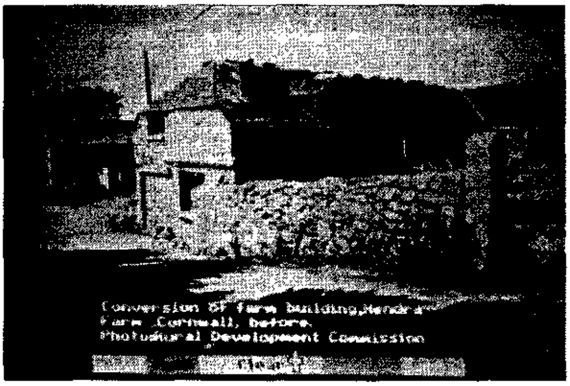

Fig. 3.29: Textual description of a photograph

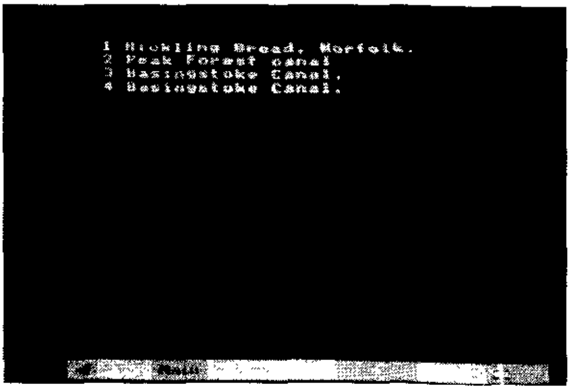

Fig. 3.30: Index of photographs

The Computer

'Computer' gives you access to the financial information for the farm, in four types of farm accounts (Fig. 3.31):

Gross Margins
Fixed Costs
Estate Finances
Balance Sheet for the Farm

To read a farm account, select that line (Fig. 3.31). Then select the return arrow at the bottom left of the screen to go back to the list of accounts to choose another account. Alternatively, by selecting 'Office' from the menu bar you can go to the Office directly.

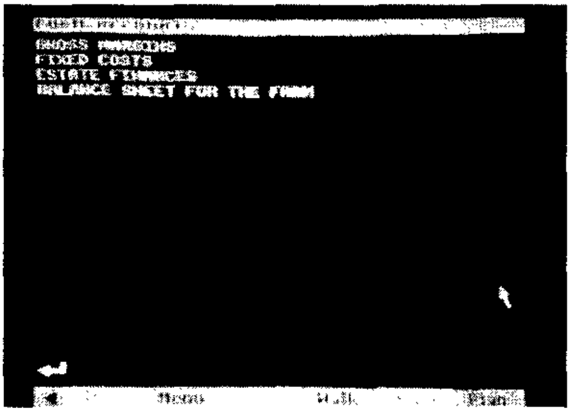

Fig. 3.31: Farm accounts

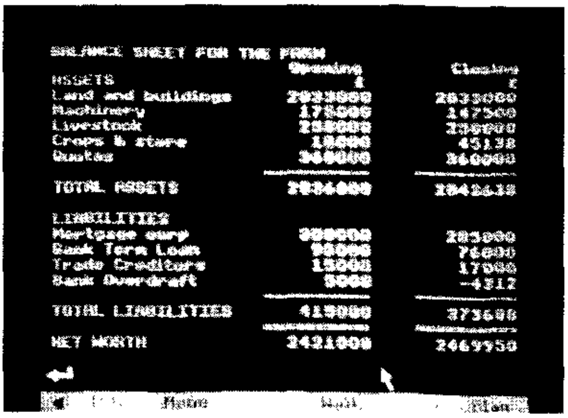

Fig. 3.32: A page of one type of farm account

3.33 The Plan

The Plan is accessed by selecting 'Plan' from the menu bar (Fig. 3.33).

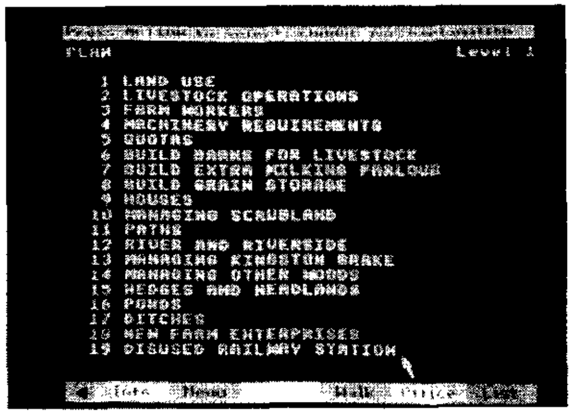

Fig. 3.33: The Plan

Within the Plan you can select actions for the future management of the farm. There are more than 100 actions available, divided into 19 groups:

1 Land use
2 Livestock operations
3 Farm workers
4 Machinery requirements
5 Quotas
6 Build barns for livestock
7 Build extra milking parlour
8 Build grain storage
9 Houses
10 Managing scrubland
11 Paths
12 River and riverside
13 Managing Kingston Brake
14 Managing other woods
15 Hedges and headlands
16 Ponds
17 Ditches
18 New farm enterprises
19 Disused railway station

Within the Plan you use both the 'action' and the 'change' buttons on the tracker ball. To select an action you point to the chosen line and press the 'action' button. To get more information about an action, you point to a line and press the 'change' button. This gives a page of text explaining the action chosen. It is necessary to select 'Return' from the menu bar to go back to the original screen.

Actions are selected by working through a series of screen displays, called Levels. The screen that displays the 19 categories of actions (the first screen in the Plan) is Level 1 (Fig. 3.33). In this program, Level 1 is the top level. Fig. 3.34 shows the Level 1 menu bar:

◀	Info	Menu		Walk	Office	List

Fig. 3.34: Level 1 menu bar

Info gives access to the following three options:

Help: gives a text explaining how to select and use the Plan; when Help is selected, the menu bar changes.

Return: takes you back to the normal menu bar, and

Guide: the presenter explains how to use the Plan and what options are available in it.

'Menu' takes you back to the main menu (Fig. 3.1), 'Walk' and 'Office' take you back to the Walk and the Office . 'List' gives a list of all the farm management actions that you have taken so far (Fig. 3.35).

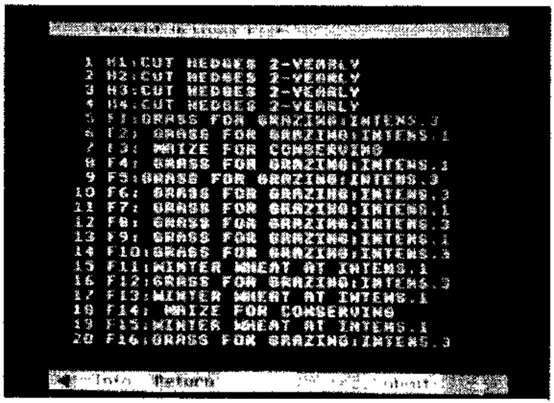

Fig. 3.35: The List

If you select 'List' soon after arriving at the farm (without selecting any actions), it shows all the actions currently being carried out on the farm. After you have made changes it shows the actions that you have taken. It shows the crops together with the intensities of cultivation and other actions for each field. It also shows the actions in the ditches, ponds, the number of livestock, farm labour and the machinery. In addition it will list how the houses on the farm are managed, together with information about loans, mortgages, etc. From the list you can return to Level 1 (or whatever Level you are in) by selecting 'Return' on the menu bar.

The outcome of pressing the 'action' button depends on what Level you are in. Level 1 is the highest level. If you are in one of the higher Levels (Level 1 or 2), you will move down to the next level. If you are at the bottom level for a particular action, you will actually select that particular action.

By pointing to a category and pressing on the 'action' button, you move down to the Level 2 for that particular action (Fig. 3.36). Fig. 3.37 shows the menu bar of Level 2. The menu bar is the same for other lower levels, Level 3, 4, etc.

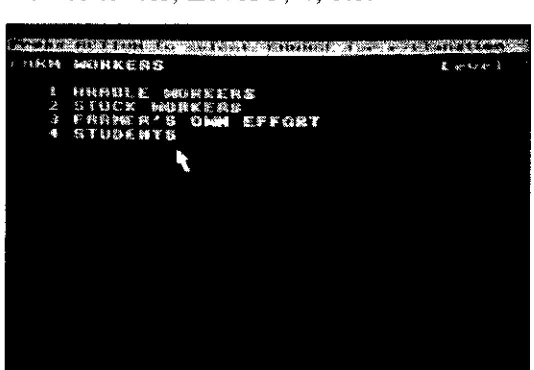

Fig. 3.36: Level 2

◄	Info	Menu	Top	Up	Submit	List

Fig. 3.37: Menu bar of Level 2

'Info' and 'Menu' provide the same options described above.

'Top' takes you back to Level 1. 'Up' takes you up one level. For instance, if you are at Level 3, you will move back to Level 2. 'Submit' is used when you are happy with the choices you have made and want to submit the management plan. If you select 'Submit', the Presenter will explain that the plan has been looked at by everybody concerned. Once you have submitted the plan you can return to the Office and/or the Walk to see the consequences. If you select 'List' you can read the list of actions that you have submitted.

Selecting actions

The list of 19 categories is Level 1 (Fig. 3.33). To make any decisions, you begin at Level 1, the top level and go through the hierarchy of levels. The case of 'Farm workers' (3rd among the 19 categories of actions) illustrates how to select an action. To select the number of farm workers, you move the pointer on the screen to the line 'Farm workers' and press 'action' button. This takes you down to the next level. Level 2 for Farm workers (Fig. 3.36), where the screen shows four choices:

1 Arable workers
2 Stock workers
3 Farmer's own effort
4 Students

You can make decisions about how many arable workers you are going to employ on the farm, how many stock workers, and so on. You can make decisions about one of the above, all of the above, or none of the above.

To select one of the above, you place the pointer and press the 'action' button. This will take you down to the next level, Level 3. If you want to make decisions about Arable workers it will give you the following list of options, at Level 3 (Fig. 3.38):

0 arable workers
1 arable worker
2 arable workers
3 arable workers
4 arable workers
5 arable workers
6 arable workers
7 arable workers
8 arable workers
9 arable workers
10 arable workers

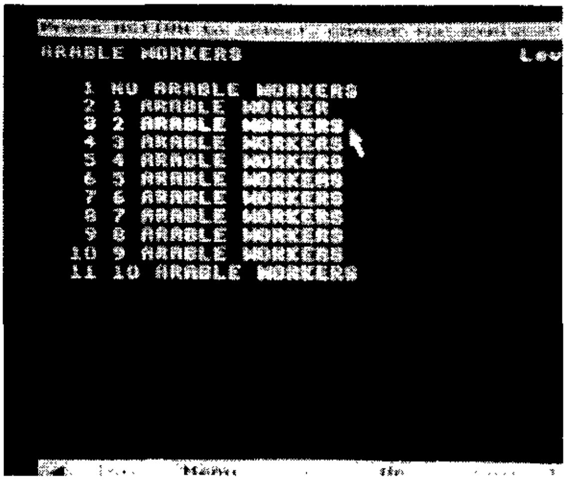

Fig. 3.38: Level 3

The number of arable workers currently employed by Poul Christiensen (the current farmer) is indicated by yellow highlighting: if the line '3 arable workers' is highlighted, it means there are 3 arable workers at the moment. You may want to change it (take an action on arable workers). To take an action you point to the line you want: to increase the number of arable workers to six, you point to the line '6 arable workers' and press the 'action' button. Now you have selected an action and it is highlighted. If you are happy with the existing number of arable workers you can leave that page without selecting any actions.

After making a selection (or not making a selection), you may want to make changes in the number of stock workers, too. For that, move up to Level 2, back to the four kinds of workers. In order to move up the hierarchy one step at a time, point to 'up' on the bottom menu bar and press the 'action' button. At Level 2 you can point to Stock workers and get a list of options available in Level 3 for Stock workers. After making a selection, you can move up to Level 2 and continue with the other two items. If you do not want to make any changes to any of the above you can move to the top level by pointing to 'top' on the menu bar and pressing 'action'. This takes you directly to Level 1 that gives the list of 19 categories.

At any Level you can get a description of any of the items by pointing to a chosen line and pressing the 'change' button on the trackerball. This gives a page of text explaining a particular action or a category (Fig. 3.39).

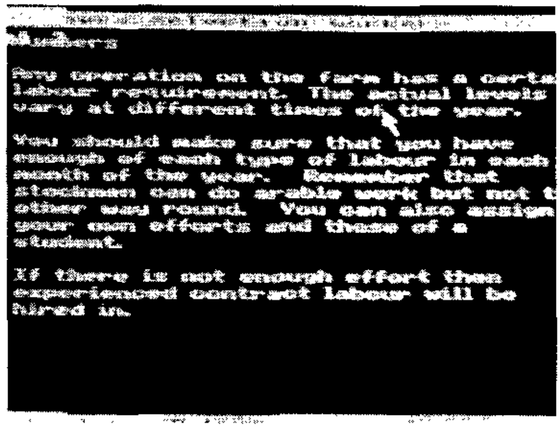

Fig. 3.39: Explanation of an action

After reading the text you can return to the Level you were in by pointing to 'Return' on the menu bar and pressing the 'action' button.

In this way you can go through a certain number of categories and select your actions, depending on your particular interest. If you are particularly interested in agricultural aspects of the farm, you are likely to be interested in the following at Level 1:

1 Land use
2 Livestock operations
3 Farm workers
4 Machinery requirements
5 Quotas
6 Build barns for livestock
7 Build extra milking parlour
8 Build grain storage

If you are interested in conservation and wildlife, it is likely that you may want to look at:

10 Managing scrubland
11 Paths
12 River and riverside
13 Managing Kingston Brake
14 Managing other woods
15 Hedges and headlands
16 Ponds
17 Ditches

If your particular interest is the rural economy, the following may be of more interest to you:

9 Houses
18 New farm enterprises
19 Disused railway station

Since the three aspects are inter-related you will find that it is necessary to look into all of the above if you are going to draw up a balanced farm management plan.

While making the plan, you will notice that the program makes a 'bleep' sound and does not allow some of your actions. This is because choosing an action depends on other circumstances, too. For instance, to select a certain number of dairy cattle for the farm, you need to make sure that there is both sufficient grazing and sufficient conserved fodder for winter. Several actions are inter-connected in this way. The main connections are between the farm operations that include:

Crops
Livestock operations
Workers
Machinery
Quotas
Barns
Milking parlours
Grain storage

There are many other actions which are linked in the sense that they depend on spending money which in turn is allowed if the overdraft limit is not exceeded.

The computer model which controls the simulation has these inter-connections built into it as a set of 'rules'. Whenever you select an action the computer will consult all these rules. If none of the rules are broken you will be allowed to continue. If however the computer finds that one of the rules has not been satisfied, it will 'bleep' and display a message in the top message bar of the screen and it will not allow the new action. If this happens, you may attempt another action, or the alternative is to change the related circumstance to make the new action allowable, such as generating income by selling houses before embarking on new farm enterprises such as converting the barns into workshops.

Submit the 'plan'

The series of farm management actions that you have selected is called a 'plan'. You submit your plan by selecting 'Submit' on the menu bar. The presenter explains that the plan has been looked at by everybody concerned. Once it is submitted, you can go to the Office or/and the Walk to see the consequences. In the Walk the list of plants and animals will change as a result of the actions you have taken. In the Office you are able to get the reactions of the interest groups and look at the financial implications on the balance sheet. You are free to change the plan as often as you wish.

3.34 Feedback

An important aspect for the learning from this program is the feedback it gives on your actions. The feedback offered is of two types, occurring at two stages:

- The ongoing feedback while making the plan
- The final feedback after making the plan

Feedback while making the plan

This is the feedback you get from the program while you are making selections. As mentioned before, the program takes every single action you take into account and decides whether it can be allowed based on the model and the rules built into it. If your action does not violate those rules it will accept your action. If, however, your action cannot be accepted, the program 'bleeps' and a brief message appears telling you why it cannot accept your action. This is the on-going feedback given by the program. It helps you to correct your action.

Feedback after submitting the plan

The other type of feedback you receive is after submitting the completed plan. There are three sections of the program where you get this feedback: interest groups (television) in the Office; 'computer' in the Office and in the Walk.

Interest groups in the Office

If you visit Office again, and select any or all of the interest groups, the spokesperson for that particular interest group will comment on your plan. He or she will tell you whether your plan suits that group's particular interest, giving reasons. In addition you can get more detailed text on their views on your plan.

Computer in the Office

After you have submitted the plan, the financial situation will change according to your actions. This can be read by selecting 'computer' in the Office. The changes in gross margins, fixed costs, estate finances and balance sheet for the farm are shown in figures. You can compare the new figures with the original figures and evaluate the consequences of your actions.

The Walk

Finally, you can see the consequences of the plan by visiting the Walk again. The actions you have taken have implications for the cropping and wildlife on the farm. The location descriptions will give a general statement of the consequences of your action for each location. You can also look at the list of wildlife in the fields where you have made changes. When you select the list of plants or animals it will be different to the previous one depending on the actions taken. In some cases, the abundance will increase and in others decrease, and sometimes you can see new species appearing and others disappearing. Using the lists of plants and animals you can work out the effects of your plan on the natural species.

3.4 Conclusion

Having considered the features of the Countryside Disc, after previewing it alone and together with a training organiser, I decided that it was suitable for the investigation. It is interactive in the sense that it allows farmers to act on a simulated world. It addressed the particular training need by enabling farmers to gain insight into the relationship between farming activities, environment and rural economy. It gives feedback of two kinds: an on-going feedback and feedback after making all the decisions. Finally, it includes a multimedia resource, in addition to a simulation, providing the possibility to investigate learning from both.

Chapter 4 outlines the research methodology and describes how the farmers used the Countryside Disc for their learning task in the pilot study and the main study.

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Chapter 4
Research methodology

This chapter begins by introducing and comparing two main research paradigms, leading to a justification of the paradigm adopted in the current study. It then states the guidelines for the naturalistic paradigm. Finally, it lays down the research design, with an account of how the field work was carried out in three stages. The chapter ends by describing how the data were analysed.

4.1 Research paradigms

The research paradigm decides the operating rules of the research and provides the foundation for the inquiry. Depending on the nature of the paradigm, we may look at the research problem differently, conduct the research differently and finally look for different research outcomes. Thus identifying the research paradigm is fundamental and crucial to the inquiry. However, Guba (1990) notes that defining a paradigm is a difficult task, because a paradigm is a basic belief system that governs our actions and rests on basic assumptions.

Guba (1990) and Guba and Lincoln (1989) note that research paradigms can be characterised by the way their proponents respond to three basic questions: the ontological, the epistemological and the methodological:

- the ontological question: what is the nature of the 'knowable' or the 'reality'?
- the epistemological question: what is the nature of the relationship between the inquirer and the 'knowable'?
- the methodological question: how should the inquirer go about finding out the 'knowable'?

Researchers identify two main paradigms in relation to these three questions: the conventional paradigm and the naturalistic paradigm (Guba and Lincoln, 1989; Lincoln and Guba, 1985; Guba, 1990).

4.11 The conventional paradigm

The conventional answer to the ontological question is that reality exists 'out there' in the world (Guba, 1990; Guba and Lincoln, 1989). The conventional paradigm, also termed as positivist, asserts that this reality is independent of any observer's interest in it. Hence it is objective, and operates according to natural laws, many of which are of the cause-effect form. This position is a realist ontology.

Since reality exists out there in the world, the conventional paradigm rests on an objectivist epistemology: it is possible for the inquirer to investigate the phenomenon studied, while remaining detached and distant from it. This way, the answer to the epistemological question is that the observer can find out about the reality by maintaining an objective distance. The observer will have no influence on the reality being discovered. Guba and Lincoln (1989) describe this as a dualist objectivist epistemology.

The answer to the methodological question is to employ an interventionist methodology. As Guba and Lincoln point out, once committed to realist ontology and consequently an objectivist epistemology, the inquirer must put questions directly to nature and allow nature to answer back. The observer must stand behind a thick wall of one-way glass observing nature do her work. But how can that be done given the possibility of inquirer bias and nature's propensity to confound? The conventional paradigm requires the use of a manipulative methodology that controls both, and employs empirical methods that measure the objective reality detached from the inquirer. The most appropriate methodology is thus empirical experimentalism.

4.12 Naturalist paradigm

The naturalistic paradigm takes a completely different position: there does not exist an objective reality out there in the world waiting to be found. Instead, realities are social constructions of the mind, and there exist as many such constructions as there are individuals, although many constructions may be shared. Guba and Lincoln (1989) refer this to as a relativist ontology which accepts multiple, socially constructed realities ungoverned by any natural laws, causal or otherwise. According to this ontology, truth is defined as the best informed (amount and quality of information) and most sophisticated (power with which the information is understood and used) construction on which there is consensus (although there may be several constructions that simultaneously meet that criterion).

Epistemologically, the naturalistic paradigm denies the possibility for the inquirer to keep an objective distance from the reality, because the reality is not absolute, but socially constructed. Guba and Lincoln note that, epistemologically, the inquirer and the inquired into are interlocked in such a way that the findings of an investigation are the literal creation of the inquiry process.

Methodologically, the naturalistic paradigm rejects the controlling, manipulative (experimental) approach. It accepts a methodology where the inquirer and the inquired into engage in an interactive process (Guba and Lincoln, 1989). The reality is a joint construction between the both parties involved. This reality is as informed and sophisticated as it can be made at a particular point of time.

4.13 Paradigm of the current research

The broad research problem investigated in the current study is 'how the selected computer-based medium provides effective learning for UK farmers at a distance'. In order to be confined to a positivist ontology, the answers to this research problem need to be in the form of a 'reality' existing out there waiting to be found. This reality needs to be governed by natural laws which do not take account of the observer's interest. By contrast, the naturalistic paradigm would argue that the answer to the question of 'how the selected computer-based medium provides effective learning for UK farmers at a distance' does not exist in the form of a 'reality' waiting to be found, because the problem is not a single phenomenon that is governed by some external laws. It is not absolute, but depends on the context, time, characteristics of the respondents and the interactive process between the investigator and the respondents. Therefore, it seems more suitable to adopt a naturalistic than a conventional paradigm for the current study.

Methodologically, the factors that contribute to farmers' learning cannot be studied using a manipulative methodology employed in conventional inquiry. According to Lincoln and Guba (1985), the results obtained from conventional inquiries will have a high internal validity, i.e., the investigator can be highly confident that the outcomes of the inquiry can be attributed to the manipulations made. But, how far are the findings of the inquiry applicable to other contexts? Lincoln and Guba note that the very act of controlling radically alters the environment and the results obtained may apply only in another controlled situation. So controlled experiments give results that are high in internal validity but low in external validity. This kind of an outcome will have limited use. By contrast naturalistic inquiry opens the possibility of both high credibility and transferability.

Credibility means that the results are believable to both the respondents and the inquirer. Also the results obtained are the reflections of true behaviours of the respondents in their natural environment. This will give a better understanding of the phenomenon under investigation. Can the results obtained in this study be applied elsewhere? Naturalistic inquiry does not aim to generalise findings, because the reality is dependent on the context, time and the nature of interaction between the investigator and the respondents (Lincoln and Guba, 1985). However, results obtained from a naturalistic inquiry can be transferred to another context if it is sufficiently similar and provided that the investigator can provide a deep enough description to enable the transfer of findings.

For the reasons given above, the current study takes a naturalistic approach.

4.2 Guidelines for the research

Guidelines for the research include the research context, sampling techniques, methods of data collection, data analysis and emerging theory.

4.21 The research context

Bogdan and Biklen (1992) point out that the naturalistic investigator is concerned with the context because this has major implications for the 'what' being observed. The action can be best understood when it is observed in a natural setting. Constructions cannot be separated from the world in which they are experienced. 'No phenomenon can be understood out of relationship to the time and context that spawned, harboured and supported it' (Lincoln and Guba, 1985, p. 189). Thus, naturalistic inquiries are carried out in natural settings.

For the current research, the context has major implications for how farmers learn. If this observation were in a controlled situation such as a laboratory, that situation would be an unfamiliar and artificial environment for farmers. Their behaviour could very well be abnormal, and the outcome of the research would have less applicability to the real world. So, this research was carried out entirely in contexts where farmers normally learn, i.e., their homes and offices.

4.22 Sampling

The purpose of sampling in a naturalistic inquiry is different from that of a conventional inquiry. Hence sampling methods also differ. The purpose of sampling in a conventional study is to define a sample that is representative of a population (Lincoln and Guba, 1985). Ontologically and epistemologically the conventional inquiry is founded on the belief that the reality can be observed and measured as it is and the influence of the context can be controlled by the observer so that what is observed and measured can be generalised to the populations from which the sample was drawn.

By contrast, as previously mentioned, naturalistic researchers begin with the assumption that the context is critical to the reality. They assume that each context needs to be dealt with on its own terms (Guba and Lincoln, 1989). Thus sampling cannot provide a group that is representative of some population to which the findings are to be generalised. Nor can it satisfy statistical requirements of randomness. In a naturalistic inquiry, the sample is selected to obtain as much information as possible about the particular phenomenon under study within a particular context.

Purposive sampling

Patton (1980, cited by Lincoln and Guba, 1985, p. 200-201) notes that purposive sampling serves naturalistic studies. This refers to any sampling done to serve specific purposes, rather than to generalise the findings of the research. Patton described six different purposive sampling methods:

- sampling extreme or deviant cases to obtain information about unusual cases that may be particularly troublesome or enlightening
- sampling typical cases to avoid rejection of information on the grounds that it is known to arise from special cases or deviant cases
- maximum variation sampling to document unique variations that have emerged in adapting to different conditions
- sampling critical cases to permit maximum application of information to other cases because, if the information is valid for critical cases, it is also likely to be true for all other cases
- sampling politically important or sensitive cases to attract attention to the study (or, sometimes to deflect attention), and
- convenience sampling to save time, money, or effort

Lincoln and Guba (1985) and Guba and Lincoln (1989) suggest that maximum variation sampling is the most useful sampling method for the naturalistic approach: the sample is selected in ways that will provide the broadest range of information possible. The objective of sampling is not to focus on the similarities that can be developed into generalisations, but to maximise the range of information. This will be helpful to refine the focus of the study.

The plan of sampling

Lincoln and Guba suggest a plan for an orderly emergence of the sample through a serial selection of respondents. A minimum or a maximum sample number is not considered important. Sampling is done as the study proceeds. Successive respondents are selected only after the previous respondents have been tapped and analysed. Each succeeding respondent is chosen to be as different as possible from preceding respondents. They are chosen to serve best the particular needs of inquiry at the moment (Guba and Lincoln, 1989).

Each successive respondent can be chosen to extend information already obtained, to obtain other information that contrasts with it, or to fill in gaps in the information obtained so far. The first respondent could often be someone familiar to the investigator, but successive respondents are selected according to the need to extend, test, and fill in information. Such successive respondents are most easily obtained by nominations (Lincoln and Guba, 1985). As the respondents are selected and as insights and information accumulate and the investigator begins to develop working hypotheses about the situation, the sample may be refined to focus more particularly on those respondents that seem most relevant. But where should the sampling and subsequently the inquiry stop?

The point of redundancy

In this sampling method, you identify a few members of the group that you wish to study. These members are used to identify others, and they in turn others. Unless the group is very large, as Lincoln and Guba point out, you will soon come to the point at which efforts to net additional members cannot be justified in terms of the additional energy and resources used. This point may be thought of as a point of redundancy. Thus the point of redundancy is the point at which the investigator is satisfied with the sample size and length of the study. Since the purpose is to maximise information, it is justifiable to end when little or no information is emerging from new respondents; thus information redundancy is the primary criterion. The sample may by then be large or small, but it is sufficient when the amount of new information provided per unit of added resource expenditure has reached the point of diminishing returns, that is, it would not be profitable to add even one more sample element.

4.23 Methods of inquiry

Methods are the tools and techniques used to collect data. Guba and Lincoln (1989) point out that the methods used in naturalistic inquiry are those that come more readily to hand for the human inquirer. They further mentioned that such methods are clearly qualitative methods. Humans collect information best, and most easily, through the direct employment of their senses: talking to people, observing their activities, reading their documents, assessing the unobtrusive signs they leave behind, responding to their non-verbal clues, etc. Such qualitative methods are mainly of two kinds: one is where the researcher gets information from respondents through interviewing and observing, and the other is where the researcher obtains information from secondary sources such as related documents and records regarding the respondents (Lincoln and Guba, 1985).

Bogdan and Biklen (1992) comment on the use of interviews and observations. An interview is a purposeful conversation between the researcher and the respondent (perhaps more than one respondent) that is directed by the researcher in order to get information from the respondent. In observation the researcher obtains information by observing the behaviour of the respondent in his or her natural context. Interviews could be used either as the dominant strategy for data collection or used in conjunction with observation and other qualitative methods.

Gold (1958, cited by Bogdan and Biklen, 1992) mentions the spectrum of possible roles for the observer to play. One extreme is the complete observer without any participation in activities in the setting. In this method, the researcher looks at the scene 'literally through a one way mirror'. The other end of the spectrum is a complete involvement at the site, with little difference between the observer's and respondent's behaviour. Bogdan and Biklen mention that the researcher will stay somewhere between these two extremes. The correct amount and the nature of participation will be helpful for the success of the research. In addition to these qualitative methods, quantitative methods can also be used to gather useful information and perhaps to support qualitative data.

4.24 Data analysis

The data collected from the above sample will be analysed inductively. That is the opposite of deductive data analysis used in conventional investigations (Lincoln and Guba, 1985; Bogdan and Biklen, 1992). Deductive data analysis refers to the process of analysing empirical data to confirm or to reject a hypothesis based on a theory assumed prior to the data collection. Inductive data analysis, the approach used in naturalistic inquiry, denotes that data are not analysed to prove or disprove a hypothesis held prior to the study. Bogdan and Biklen (1992. p. 32) explain the nature of inductive data analysis: 'You are not putting together a puzzle whose picture you already know. You are constructing a picture that takes shape as you collect and examine the parts. The process of data analysis is like a funnel: Things are open at the beginning (or top) and more directed at the bottom'.

Data collection and analysis need to be carried out side by side as the inquiry proceeds (Guba and Lincoln. 1989). As Bogdan and Biklen point out some of the data collected in the study are useful to refine its focus and direction. Each successive respondent of the sample can be selected in order to obtain information that was not collected from the previous respondents of the sample. Each interview or observation will uncover items of information relevant to the study's focus. Especially in the early stage of the study, open-ended questions are asked of the respondents, so that the respondents can offer their opinions as well as answers to the investigator's questions.

This continuous interplay of collection and analysis of data will be used to build the theoretical foundations of the investigation. Lincoln and Guba mention that theory that follows from data rather than preceding them is a necessary consequence of naturalistic inquiry. Glaser and Strauss (1967, cited by Strauss and Corbin, 1990) term this phenomenon as 'grounded theory'.

4.25 Grounded theory

Grounded theory is 'inductively derived from the study of the phenomenon it represents'. That is, 'it is discovered, developed, and provisionally verified through systematic data collection and analysis of data pertaining to that phenomenon. ... One does not begin with a theory, then prove it. Rather one begins with an area of study and what is relevant to that area is allowed to emerge' (Strauss and Corbin, 1990, p.23).

The idea of grounded theory does not mean that the researcher starts the study without having any theoretical foundations. The researcher will begin the study with an understanding of relevant theoretical foundations, based on professional experience and reading the relevant literature. This understanding mainly contributes to the emergence of the research problem. As Strauss and Corbin summarises Grounded theory is an outcome of a struggle to formulate a theoretical interpretations of data grounded in reality.

The purpose of grounded theory is to build a theory that is relevant and illuminates the area under study. Theory assumed before the study can only be tested and confirmed or disconfirmed. But grounded theory will contribute to the further development of the research design. It also opens the possibility for further study and understanding of the phenomenon being investigated. As Strauss and Corbin point out, these theories will ultimately be related to other theories within the particular discipline, and their implications will have useful applications.

4.3 The research design and the fieldwork

Based on the above theoretical foundations, the fieldwork was carried out in three stages:

- preparatory work
- pilot study
- main study

4.31 Preparatory work

The objective was to prepare the foundation for the study. Selecting the appropriate program was a major task in this stage. Several programs were evaluated for their suitability, and the Countryside Disc was selected (see Chapter 3 for more details of the program). A copy of the program and playback hardware was available in an office near the location of the pilot study respondents. It was not possible to borrow the program to take away, so arrangements were made to use the program within the office for the pilot study. For the main study, it was possible to borrow a copy of the program and playback hardware from a local college.

Selection of the respondents was done as far as possible according to the rules of naturalistic inquiry, within the time and resource limitations of the PhD study. There were two main considerations that governed the choice of the sampling method: one, limitation of time and resources for the study, and, two, the need to collect the widest possible range of data. In order to meet these criteria, two sampling methods were employed: convenience sampling and maximum variation sampling.

Due to time and resource limitations, it was decided to select the respondents within easy reach, hence convenience sampling was used. This sampling method is justifiable since this study did not focus on farmers from a particular geographical area or farmers who specialise in specific crops (or livestock). Efforts were made to select farmers from Buckinghamshire and Northamptonshire, nearby. Efforts were now made to select respondents from whom could be collected a wide range of data, hence the sampling method is maximum variation sampling. This sampling method does not specify a particular sample size; ideally it advocates serial sampling until the point of redundancy is reached. However, I needed to deviate from this ideal situation due to a practical limitation on this approach.

It was not possible to predict whether the point of redundancy would be reached before the end of the time allocated for the field work. Farmers were best able to spare their time from November to March, and time might run out before reaching the theoretical point at which the study should end. In order to have access to them I needed to select the respondents prior to the study. However, by continuously analysing data collected from the previous respondent, I made an effort to seek new information from each successive respondent.

Based on these considerations, I approached an ATB Landbase training organiser, with whom I was in touch from the first year of the PhD study, to get access to respondents. After discussing the objective and the nature of the study, she introduced me to five farmers who were potential respondents. Afterwards I sent a one-page description of the study to the farmers. Later, I contacted them over the phone and visited them to give further clarification about the study. On these visits I showed them photographs of the screen shots of the Countryside program. All five farmers agreed to take part in the study. The sixth farmer was introduced to me by a friend. Half way through the main study, the training organiser introduced me to another training organiser who introduced me to other farmers. I followed the same procedure as before to inform the farmers about the study and to get their consent. Out of the five respondents whom I contacted first, two volunteered to take part in the pilot study.

4.32 The pilot study

The pilot study was the trial run of the main study. The pilot study had two broad objectives: to identify the important aspects for further investigation in the main study and to test out the proposed research methodology for the main study. It was anticipated that towards the end of the pilot study, the research problem would be better focused, too.

Data collection

The pilot study followed, as far as possible, guidelines for the naturalistic paradigm (Guba, 1990; Lincoln and Guba, 1985), within the time and resource limitations of the PhD study. Video recordings, observations and interviews were used to collect data. Data collection took place in the summer of 1995. Two farmers participated in the study, using the Countryside Disc. The farmers' task was to study the farm depicted in the program and to prepare and submit a farm management plan. There was some dialogue between the users and myself during the learning sessions. At certain points the users initiated this talk whereas on other occasions I thought it was necessary to make a few suggestions so that they maintained interaction with the program. Their learning sessions were observed and studied in-depth. During the session I took notes on the farmers' interaction with the program, which was video recorded for analysis. After the session, I questioned them regarding their learning from the program. After analysis of the notes and video recordings, I again interviewed each farmer in-depth.

The initial aim was to spend about two hours on the session though they were willing to spend more time if necessary. The first user spent a little more than two hours whereas the second user spent about five hours on the learning task. There were over seven hours of video recordings and three hours of interview data. The analysis and the outcome of the pilot study are described in Chapter 5.

Data analysis

About six weeks elapsed between the two observations with the two farmers, therefore it was possible to analyse the data of the first respondent before carrying out the study with the second respondent. After completing the first observation, I viewed the videotape several times in order to identify important categories for further analysis and to decide what sections to transcribe. At this stage, the research problem was still less focused; one objective of the pilot study was to clarify the research problem. I realised that simply viewing the tape from beginning to end did not identify any pattern of important categories. Therefore I decided to transcribe the entire content of the tape. After several trials I arrived at a suitable format to record the transcriptions. Table 4.1 is a typical page of transcript:

Table 4.1: A page from the transcripts

Time	Action	Screen	Talk	My comments
2.27 [1:45] [0.08]	GUIDE	guide	**Long time we get there!** I asked what the problem was **All I wanted was get to the walk. I don't know that was what the guide was** **Is there a plan of the farm?** I explained the plan: You can look at the plan by going back to the walk and looking at the map **That's where you need to start, the map of the place. I don't know how you get there.**	Does the guide give enough details about how to navigate within walk? What is missing in the guide's explanation? He wanted a tool that he is used to having, using in his life and work. He talks quite a lot and several times later about the kinds of details he would prefer in the map. The second time came across a problem as to how to navigate; the problem of understanding the interface, problem with the interface,
2.29 [0.28]	WALK	walk	Pointing towards the 'plan' on the menu bar: **I mean plan there doesn't mean plan' is it?** No that is the plan you are going to make" What I was explaining was, this .... (He thought I was again going to explain how to use arrows to navigate within walk) **Yes, I tried that to start with, (meaning he was in the walk using arrows but it didn't mean anything or it didn't achieve anything or it is not a good way of doing it or ...) but it didn't where I am. I mean I didn't know where I was going, without the map I didn't know where I am** Moving the pointer towards the map on the menu bar: **If I to options....?**	Again the interface gives a problem. The 'plan' is confused with the plan of the farm the farmer is looking for. wants a focused way of the search
2:30 [0.04]	OPTIONS	menu bar changes showing map	If you go to options... then you can go to the map **Haa!** (he sees the word map on the menu bar)	He was delighted and satisfied as he sees he can get what he wanted.

There are four main types of information in the transcripts under four main columns: the time index, the action that the user does (what part of the screen the user clicks on or selects), what appears on the screen, the user's comments and the conversation between the user and myself. In addition I recorded my own thoughts during the transcription process, in a fifth column.

When I had gone through the transcripts several times, along with watching the video recordings, some important categories, related to farmer's learning, emerged, mainly from the analysis of the farmers' comments and the conversation between each farmer and myself (fourth column in the transcripts) and the analysis of the navigation pattern (first and second columns in the transcripts). These categories were then classified and further analysed (Chapter 5 deals with the analysis and the outcome of the pilot study). The data analysis of the pilot study paved the way to identify categories for the main study.

4.33 The main study

Ten farmers took part in the main study that started in November 1995. This was the season when farmers have more time for training. The initial aim was to complete the main study by the end of March 1996. However, this plan had to be changed some farmers had to postpone their schedules, with knock-on effects.

The individual learning task for the farmers was to gather information and prepare a management plan for the farm depicted in the disc. This task allowed them to explore the implications of their farm management decisions not only for financial profitability, but also for the environment and the local economy.

Data collection

The learning exercise was entirely carried out in farmers' offices or homes. I took the Countryside Disc and the playback system to each farmer in turn and left it with them for a week, or more in few cases. Lessons learned from the pilot study were helpful to improve the main study. In the pilot study, the time given by the individual farmers for completing the learning task was limited to a couple of hours or more in one afternoon. They suggested that they needed at least one week to understand the program better. So it was decided to let an individual farmer carry out the learning session for a week. In this way an individual learning session was divided into three phases:

The first observation

This was the day the program was taken to the farmer. The objectives of the first day's session were for the farmer to:

- become familiar with the program
- get necessary information
- prepare a small scale farm management plan
- submit it and receive feedback

Fig. 4.1 illustrates a typical observation session.

Fig. 4.1: A typical observation session

The first session was entirely observed and video recorded for further analysis. I learned from the pilot study to give more help when respondents faced problems with the program and to encourage a natural conversation between the respondent and myself. These conversations helped me to gain some understanding about their thinking during the session. By helping them with the problems related to using the program, I was able to let them progress and focus on the learning issues while making notes of their problems.

The practice week

This was the one week (or more) when the farmer used the program to get more information, prepare a few plans and submit these. During this week they were free to spend as much time as they wanted to on the program. The majority of the respondents kept notes of their work during the practice week.

The second observation

At the end of the week (or in a few cases, more than a week) I met the farmer again and observed and video recorded the learning session. The task for the farmer in this session was to prepare and submit a farm management plan based on the knowledge and experience gained during the week of using the program on their own. Some farmers came with a well prepared and tested farm management plan whereas others started the session with a certain idea about the plan they were going to make. They prepared and submitted the plan and received feedback for their actions (Fig. 4.2).

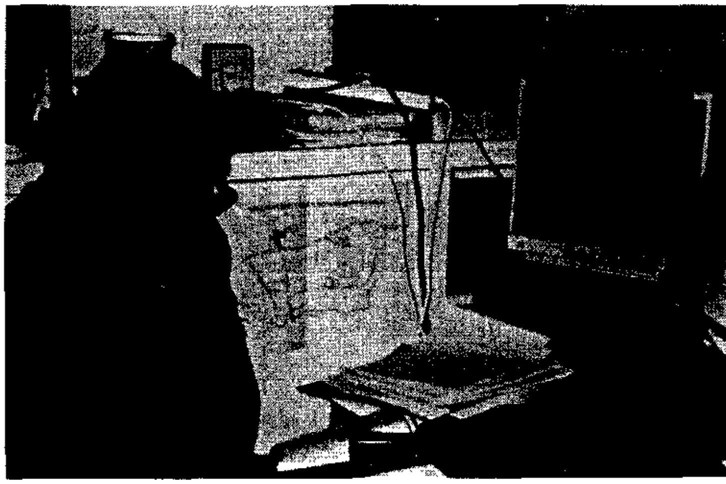

Fig. 4.2: A farmer listening to the feedback on his plan

Upon receiving feedback, the farmers reflected and commented on it. Some went on to change their plans based on the feedback. Table 4.2 shows the length of time each farmer spent on each observation.

Table 4.2: Length of observations

Name of the farmer	Length of the 1st observation	Length of the 2nd observation
Martyn	2 hours 50 minutes	5 hours
Tim	1 hour 40 minutes	1 hour
Steven	2 hours 20 minutes	2 hours 40 minutes
Robert	3 hours	1 hour 50 minutes
Neil	1 hour 50 minutes	2 hours
Joyce	1 hour 50 minutes	2 hours
Duncan	2 hours 30 minutes	1 hour 55 minutes
Simon	2 hours 10 minutes	2 hours 15 minutes
Ian	1 hour 15 minutes	1 hour 30 minutes
William	2 hour 10 minutes	4 hours

At the end of each observation I asked a few questions about the learning session. I did a follow-up interview after transcribing the observation data.

Data analysis

Transcription was the first stage of the data analysis. I followed the method adopted in the pilot study to transcribe the videotapes. The main study consisted of about 47 hours of video recordings which took a considerable amount of time for transcription. Each videotaping was transcribed soon after the observation. The one-week gap between two consecutive observations provided the time needed for this lengthy process. Transcribing itself can be considered as the first stage of data analysis because, during the transcription process I was able to go through the tapes thoroughly to get a better understanding of how the previous learning session went on before moving to the next observation. This helped me to focus on specific issues during each of the subsequent learning session. This process is considered important in naturalistic inquiry to obtain a wide range of data from the respondents.

Due to changes in the observation schedules, my observations and follow up interviews with nine respondents took nearly seven months, from November 1995 through to the end of May 1996. The second observation with the 10th respondent was postponed several times and eventually done in December 1996. All the video recordings and audio recordings of interview tapes were completed towards the end of May 1996. By this time I had viewed the video tapes several times. Included in the transcripts were my preliminary comments which made the basis for the further analysis.

In the preliminary stage, cases of individual respondents were analysed separately. Two respondents who were unable to complete the learning task, and their data were analysed separately to understand the reasons for their problems (see Appendix 1). The data of those who were completed the task gave rise to four main aspects for further analysis:

- how the users collected information from the program
- how the users made their plans
- how the users evaluated their plans and reacted to the feedback
- navigational problems faced by the users

The first three aspects emerged from three steps the users followed during the learning sessions – getting information from the program, making decisions, and evaluating the feedback for their plans. Further analysis of these issues were carried out based on relevant theoretical foundations. This 'inductive data analysis' – analysing data not to prove or disprove a hypothesis held prior to the study but to build the theoretical foundations of the investigation (Bogdan and Biklen, 1992) – is the method used in naturalistic inquiry. Analysis of data gives rise to the theoretical foundations, 'grounded theory' (Glaser and Strauss, 1967). Fig. 4.3 outlines the data analysis.

Further analysis of the previously mentioned three aspects (points 1, 2 and 3 in Fig. 4.3) paved the way to identify different learning approaches of individual learners and to examine how these approaches influenced their decision-making process and consequently the final learning outcome. This analysis falls into the broad category of learning style. The fourth and the fifth aspects, the navigational problems and the cases of farmers who were not able to complete the learning task illuminated the problems the learners encountered in learning from the program (points 4 and 5 in Fig. 4.3). I categorised the navigational problems the users faced and discussed the implications of navigational problems for the learning style. Finally, I examined the cases of those who were not able to complete the learning task and discussed the reasons for their problems.

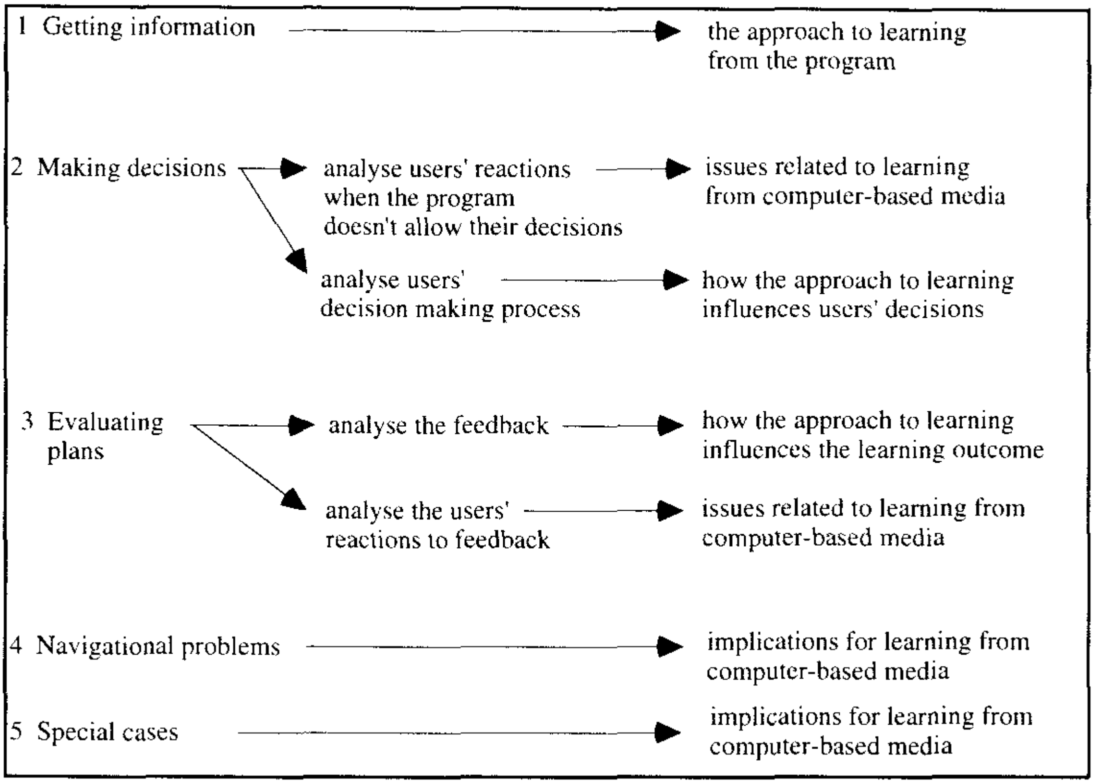

Fig. 4.3: A diagrammatic representation of the data analysis process

4.4 Conclusion

This chapter outlined the research methodology used in this research. It introduced and compared two main research paradigms, and justified the paradigm adopted in the current study. It then stated the guidelines for the naturalistic paradigm. It laid down the research design, with an account of how the field work was carried out in three stages. Finally it described how the data were analysed. Chapter 5 reports the data analysis of the pilot study.

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Chapter 5
The pilot study

This chapter describes the data analysis and outcome of the pilot study that was carried out to lay the foundation for the main study. Firstly, it mentions the focus of the study. Secondly, it gives a detailed analysis of the data. Finally it summarises the outcome of the pilot study and states the categories identified for the main study.

5.1 The focus of the pilot study

The research problem of this thesis is to examine how a selected interactive computer-based medium enables farmers to gain a deep understanding of the interplay of various factors involved in present-day farming and make profitable farm management decisions, while observing public opinions and regulations. Two aspects to be focused on in this investigation are: the instructional interactions and learner-interface interactions, because these influence how farmers learn from computer-based media. The program selected for the study is The Countryside Disc.

What kind of data can illuminate this research problem? The pilot study, as the trial run of the main study, needed to answer this question. It had two broad objectives: to identify the important aspects for further investigation in the main study and to test out the proposed research methodology in the main study. During it, the research problem became better focused. Fig. 5.1 illustrates the pilot study.

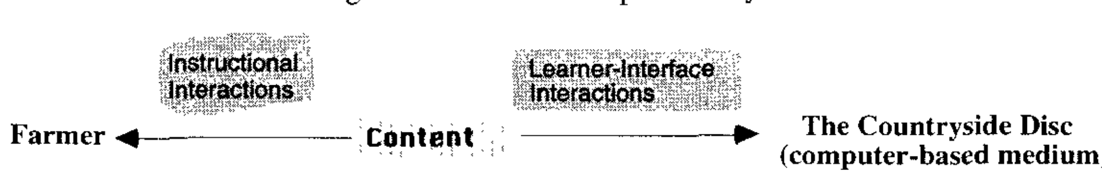

Fig. 5.1: The pilot study (adapted from Edirisingha, 1996, p. 2)

Section 4.3 (Chapter 4) describes the methodology and data collection procedure. This chapter analyses and discusses the data.

5.2 Analysis and discussion

The data analysis was based on Laurillard's (1993) 'conversational framework' that models the student-teacher interaction (described in section 2.31 of Chapter 2). There were two reasons for this choice. Firstly, Laurillard's framework discusses an academic learning situation. The Countryside Disc provides a similar learning activity; it allows the user to understand the relationship between different farm management decisions and the financial, environmental and other economic aspects through an extensive and complex simulation. It does not provide practical skills training to the user. Secondly, Laurillard, extending her analysis, replaced the teacher with different media and discussed in detail how each medium supports the essential functions of the teaching and learning process.

Chapter 3 showed that the Countryside Disc is a mixture of more than one medium. It is a combination of a 'multimedia resource' and a 'simulation'. The Walk, the Office and a few links in the Plan, present information to the learner, hence it is a 'multimedia resource', as defined by Laurillard. Such a resource, in its general form, functions as an information retrieval system. Learners can access information stored in any form, including audio and video, either on a hard disc, on a compact disc, or as in this case a laser vision video disc. The Plan section of the Countryside Disc allows the user to make inputs and see the results, thus it is a simulation. It '... embodies some model of an aspect of the world, allows the user to make inputs to the model, runs the model and displays the results' (Laurillard, 1993, p. 130). The program displays its behaviour in response to the inputs as textual descriptions, pictures, sounds, numerical values or combinations of these.

The data analysis was two-fold:

(1) analysing the activities between the learner and the program, and
(2) examining the important aspects within each activity

5.21 Activities between the learner and the program

Table 5.1 presents the analysis of the activities between the learner and the Countryside Disc, based on Laurillard's 'conversational framework'. In the table, there are two main columns. Column 1 consists of four sub-columns and covers the 'conversational framework'. The first sub-column is the four educational functions; the second is the 12 activities between the student and the teacher. The third and the fourth sub-columns replace the teacher by the multimedia resource and simulations respectively, and highlight the possible activities between the learner and the respective media (Laurillard, 1993). The second main column presents the observations of the pilot study. It is divided into two sub-columns: the first is the activity between the learner and multimedia resource; and the second is the activity between the learner and simulation.

Table 5.1: Analysis of activities between the learner and the Countryside program

The Conversational Framework				**The Pilot Study**	
Educational Function	Activity between Student (S) and Teacher (T)	Activity between Learner and Multimedia Resource	Activity between Learner and Simulation	Activity between Learner and Multimedia Resource	Activity between Learner and Simulation
Discursive	1 T describes conception	possible	not possible	did not occur	-
	2 S describes conception	possible	not possible	did not occur	-
	3 T describes conception in light of S's conception or action	not possible	not possible	-	-
	4 S redescribes conception in light of T's redescription	possible	not possible	did not occur	-
Adaptive	5 T adapts task goal in light of S's description or action	not possible	not possible	-	-
Interactive	6 T sets task goal	possible	possible	**occurred**	**occurred**
	7 S acts to achieve task goal	possible	possible	**occurred**	**occurred**
	8 T's world gives feedback on action	possible	possible	**occurred**	**occurred**
	9 S modifies actions in light of feedback	possible	possible	**occurred**	**occurred**
Adaptive	10 S adapts action in light of T's description	not possible	not possible	-	-
Reflective	11 S reflects on interaction to modify description	not possible	not possible	-	-
	12 T reflects on action to modify description	not possible	not possible	-	-

It can be seen that the Countryside Disc generated the activities 6, 7, 8, and 9 which are interactive. There were no activities in the adaptive (activities 5 and 10) and reflective functions (activities 11 and 12); the activity 3 in the discursive function did not occur, either. This analysis is supported by Laurillard's argument that not all media can provide all four educational functions. According to her, multimedia resources and simulations generate neither the adaptive nor the reflective functions. Simulations do not have a discursive function.

In principle, multimedia resources can generate the 1st, 2nd and 4th discursive activities, although these activities did not occur between the farmers and the multimedia component of the Countryside program. This could be attributed to the design of the program. According to Laurillard, these activities can occur if multimedia are designed to facilitate tutorial inputs and to allow learners to make annotations to the original text in order to compare them with the author's text. Since the multimedia component in the study did not have these designs, the program did not generate the above activities.

The 6th interactive function, i.e., multimedia and the simulation setting the task goal to the learner, needs special mention. It occurred in the study, though in a slightly different way. The two media did not set the task goal to the learner individually, again due to the specific design of the program. Since the Countryside Disc is a combination of the two media, it gave the overall learning task to the learners in its introduction, rather than setting task goals by each component media separately.

Based on the above analysis, the following could be identified as the actual activities occurred between the learner and the Countryside program:

- Within the introductory section:
  — the program sets the overall learning task to the learner
- Within the multimedia resource:
  — learner acted to complete the task of gathering the information required to complete the plan (i.e., learner sought information)
  — program gave feedback on actions, displaying requested information in a variety of forms (i.e., program presented information)
  — learner modified actions in light of program's feedback, and requested more information
  — the program presented more information to the learner.
- Within the simulation:
  — learner acted to achieve task goal (i.e., learner made decisions and makes inputs to the simulation)
  — program gave feedback on action (i.e., the simulation gave feedback to the learner)
  — learner modified actions in light of feedback (i.e., learner modified his plan based on the feedback)
  — the program gave feedback on the modified actions.

The above situation can be explained in terms of nine activities (see Fig. 5.2 below):

(1) Program presents learning task
(2) Learner seeks information
(3) Program presents information
(4) Learner seeks more information
(5) Program presents more information in various forms
(6) Learner puts input to the program
(7) Program gives feedback in various forms
(8) Learner modifies input
(9) Program gives feedback on modified inputs.

Each individual activity will be analysed further in order to identify how learners interacted with the program

5.22 Important aspects within each activity

The nine activities are presented in Fig. 5.2. The analysis of each learner's behaviour during each activity and of the way the program reacted to the learner provided information on how farmers learned from the program and the problems they encountered. It also highlighted the categories to be studied in detail in the main study.

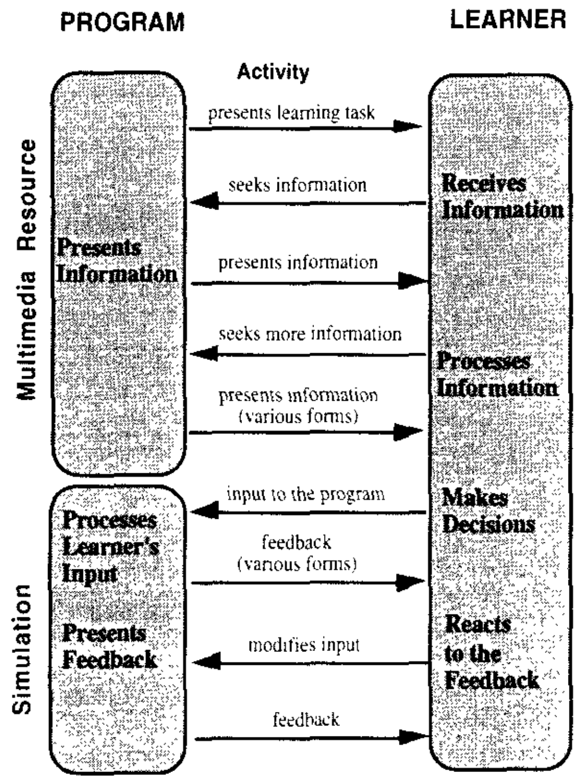

Fig. 5.2: The activities between the farmer and the program

Program presents the learning task

The program presents the overall learning task to the learner at the beginning. When the learner selects 'Simulation', a short videoclip introduces the program and explains the learning task. It also briefly gives instruction on navigation within the program. The introduction of the program is presented by the Guide. This video sequence ends with the presenter inviting the user to try one of the three main sections of the program: the Walk, the Office and the Plan.

Learner seeks information from the program

The Walk and the Office are the two sections that provide the information necessary to make the planning decisions. However, the user can get more specific information from the Plan section. All three sections can be accessed non-linearly by clicking on the words Walk, Office and Plan on the menu bar at the bottom of the screen. Within each section, learners continue to navigate by clicking on arrows, various clickable items and words on the screen that appear at different stages.

Neil and Martyn are the two farmers who participated in the study. Neil spent about an hour (half the time he spent on the learning session) in the Walk and Office, whereas Martyn spent about three hours (more than half the time he spent on the learning session). The pattern of interactions revealed important issues with regard to their learning, in particular the range of navigational problems they encountered. Some they overcame independently, but occasionally I had to intervene.

Difficulty in understanding how to use the interface to progress

When the users came to a new section of the program, they had difficulty in moving ahead: they were unable to understand the interface. Martyn selected 'Walk' and the Walk screen appeared. Then he stared at the screen for about one and a half minutes:

> Am I supposed to be doing something?

He was waiting for something to happen:

> ... don't know what it is supposed to be doing for me ...

Neil also moved into the Walk. He kept looking at the screen for 45 seconds and then called up the Guide. The Guide explained (on-screen) what the learner could do within the Walk and how to do it. Then Neil selected 'Info' to get textual help. After being in the Walk for five minutes, having called the Guide once and textual Help once, Neil said:

> ... I am not actually quite sure how I move. ... Do I have to move on to ..., or the walk, I wasn't sure how I move

In the Walk, the user's task is to move around the farm assessing the resources and wildlife in selected locations. Navigation is by selecting arrows on the screen and words on the bottom menu bar. The learners were aware of the learning task within the walk but were not clear how to use the interface to achieve it.

On another occasion, Neil was unable to look at plants and animals within the Walk:

> It doesn't allow ..., why, do I have to go to 'Options', because it hasn't got the choice of animals and plants now, has it?... . Is it under 'Menu' or 'Options'?

You have to click on 'Options' to get to the next screen that shows menu options such as 'Map', 'Description', 'Plants' and 'Animals'. 'Map' takes you to the map of the farm indicating your position at a particular point; 'Description' gives you a textual description of the position; 'Plants' a list of plants at that point; and 'Animals' a list of animals.

The second place where the farmers had difficulty in progressing was the Office. Martyn selected 'Office' and the Office screen appeared. He looked at the screen for nearly a minute and said:

> Now what have I got here?

Neil also encountered the same problem within the Office. He did not do anything when he was presented with the Office screen and went instead to the Walk. He came back to the Office again about half an hour later, but again was not going to get any information from the Office before making his plan. The reason why he did not look at the Office was revealed when I specifically suggested that he should look at the Office just before making his farm management plan:

> I went to the Office, but nothing happened, so I ...

Once in the Office, you can see a photograph of an office with six items: a television screen, a VCR, a stack of files, a computer, a map on the wall and a window overlooking the farm. By clicking on each item, the user can access details of interest groups, a videoclip of the farm, the financial accounts, a few essays on case studies of farming and related enterprises, the map of the farm and the Walk section of the program. 'Info' on the bottom menu bar gives textual help, or alternatively the 'Guide' gives an explanation about the Office with instructions on how to move ahead. However, the farmers did not select any of these items. It appeared that they could not understand what icons to use in order to navigate within the Office.

Similarly, when the farmers went to the Plan section of the program, they were unable to understand what to do immediately. Martyn looked at the list of things to do in the Plan for more than a minute and then asked:

> What does that tell you to do?

He had difficulty in moving ahead when he came to a completely new section of the program. The beginning is fairly easy: the user just has to click on 'Simulation'. The introduction ends by asking the user to select one of the three words on the menu bar: the 'Walk', the 'Office' or the 'Plan'. The farmers had no difficulty in doing that: they selected 'Walk'. But once in the Walk they faced a few arrows on the screen and a menu bar with new words. The interface becomes more and more complex as the user proceeds.

The same is true of the first screen in other sections: in the Office section it is a picture with few items in it, and the Plan presents a list of activities. In both cases the menu bar is more complex. The Guide gives a brief introduction as to how to navigate within each section but that explanation with new words is something the user may find hard to grasp.

Difficulty in understanding how to use the interface to get more information

At certain points the farmers were looking for particular information or were wanting to execute certain manoeuvres, but were unable to do so because they did not know how to use the interface for that particular task.

The first instance was when Martyn wanted to look at the map. He asked if there was a map of the farm because he did not know how to get to the map. A second instance was when Martyn wanted to move the location indicator, the blue arrow, on the map. He wanted to move his location. He tried to move the indicator by moving the pointer but the location indicator did not move:

> I am not going to move that, am I? That's why I'm standing there

The next instance was when Martyn wanted to go back one screen; he was not sure which icon to press. He pressed the wrong one and realised that it did not take him to the previous screen:

> Doesn't it just drop me back once?... Oh! I just wanted to get one step that's all

Martyn faced a similar problem when he wanted to get to the Walk screen, which has got a few arrows in the bottom left hand corner. By clicking on an arrow, the user can move in the direction where the arrow points. Martyn wanted to use this facility but was not sure how to get to this particular screen:

> I am not getting them ('arrows') now, am I? You can get it on the Walk one

A common problem was how to escape from certain sections of the program which they came to by mistake. One instance was when Martyn selected 'Guide':

> Ah! that switches back to that! ... (waits for the Guide to start) ..., How do I escape out of that?

Other instances of when Martyn came across the same problem were: to start the program when he came to the very first screen of the program; to get to the list of the interest groups when he had just finished listening to one of them; and to cancel a management decision he had made prematurely.

Neil also faced similar problems. He was trying to move from one place to another by using the arrows at the bottom of the walk screen. He changed position 12 times and then looked at the list of animals and the textual description of the last location. He found out that he was still in the same area of the farm. He had not moved significantly:

> I can't get out of here. ... Still the barn site. ...I can't seem to get out of the corner, I am stuck in the corner.

To change position within the map, the user needs to choose the desired position on the map using the pointer and click. Then the blue arrow (the location indicator) on the map moves to the new place. Neil tried it and was satisfied that he could eventually use the map to change his position on the farm:

> Hah, Hah! We got away from it.

It took 15 minutes for Neil to understand how to navigate using the map, and this was after he had read the textual 'Help' and listened to the 'Guide' in this process.

In each of these places the users were facing a screen with icons and words whose representations were not familiar to them. The users knew that the information they were looking for was there in the program. In order to get that particular information or to move to a particular section of the program the users needed to click on an icon followed by one or two more manipulations.

Difficulty in understanding the meaning of icons and words within the interface

There were a few occasions when the meanings of clickable words on the menu bar and of icons on the screen were unclear to the user. Further navigation was affected.

Martyn looked at a few screens of the Walk. In this section he was looking for a plan in order to orient himself to the farm. He clicked on 'Guide' without knowing what it would really take him to. The Guide appeared and told him that he was in the Walk section, then went on to explain what the user can do in the Walk. But it was not what Martyn expected to get by clicking on 'Guide':

> All I wanted was get to the Walk. I don't know that was, ... what the 'Guide' was

He apparently thought that the 'Guide' meant a guided tour of the farm.

There were two other occasions when Martyn understood 'Guide' differently: when he was looking at the textual description on a Walk screen and when he was reading a textual help screen within the Walk section.

Martyn misunderstood the word 'Plan', too. By 'Plan', he meant a map of the farm, and when he saw the word 'Plan' on the menu bar at the bottom of the screen, he asked:

> I mean 'Plan' there doesn't mean a plan, is it?

Other words that Martyn did not understand were 'Info' and 'List' when he was looking at a textual description of a photograph of a plant and at different options for making a farm management plan; 'Animals' when he was looking at a photograph of the milking parlour of the farm; 'Help' when he was looking at the map of the farm; and 'Options', 'Office', 'Plan' and 'Menu' when he was looking at the photograph of the farmyard. 'Options' was a problem when he was in the 'Walk' section, too.

As far as the icons were concerned, it was unclear what the direction indicator on the top right hand corner represented. It is an icon showing all eight directions in which the user could look, with an arrow showing the direction in which the user is looking at any particular time. Martyn thought it was showing the north and was not accurate:

> It's deceiving because north on the map is north there, but then it takes you for a walk north over to the side
>
> ... I thought it was the direction I was travelling

Another iconic representation that was unclear was in the Office screen. Martyn did not understand what the stack of files represented.

There could be several reasons for this misunderstanding. Firstly, the user may give meaning to words based on his or her own experience. Martyn thought that the 'Guide' would guide his walk and that 'Plan' meant the map of the farm. A second reason may be that the user interprets words differently depending on the context in which they appear. A good example was that one user thought 'Animals' meant farm livestock. A third reason may be the specialised meanings given to clickable words. 'Info', 'List', 'Options' and 'Menu' have their own meanings in this program, and the user needs to be familiar with these meanings in order to understand how to navigate. A fourth reason may be lack of familiarity with the program. Navigation becomes easier as the user becomes more familiar with the meaning of the new words and icons.

Difficulty in understanding the meaning of text on screens

Understanding the content of the screen was a problem users faced, especially in the Plan. The Plan contains a list of activities that the user can do when managing the farm; the user can get a breakdown of each activity as he or she proceeds.

When Martyn clicked on 'Plan' on the menu bar, the list of 19 activities appeared. He looked at it for a little over a minute and asked:

> What does that tell you to do?

When clicked on, each item takes the user to the next level for that action. The list of 19 categories is the Level 1 and is the highest level. The number of levels vary between 3 and 5. Each level is represented on a separate screen (more details in Chapter 3, section 3.3). Martyn found it difficult to understand what each of these screens represented. At one point he selected 'Landuse' from the list. It took him to another list (Level 2 for 'Landuse') that gave the breakdown of the fields with numbers. When these numbers appeared Martyn asked:

> What are these numbers on the right hand side then?

Similar problems were observed on a few other occasions in the Plan, particularly when the user was trying to get more information about each activity he could do in making his farm management decisions. At certain points, because of this, I needed to work through each screen with the user.

In the Plan section the user had to grapple with two things together: making sense of what the screen presents and using the interface to get more information from each item on the screen. The video and photographs are straight forward in providing information. They just show and explain certain aspects of the material. However, the textual parts are more abstract. The user needs to make sense of this abstract material. When coupled with the problem of how to use the interface to get necessary information, the user finds the program even more difficult.

Difficulty in knowing that vital information is available

As the farmers went through the Walk they skipped some of the facilities provided in the program that enable them to go into more detail.

Within the Walk the user can look at photographs of various plant and animal species at any particular place on the farm. Martyn looked at the list of plants on the farm after 10 minutes. He looked three times at the list of plants and once at the list of animals during the next 16 minutes. When asked why he did not want to look at the photographs and textual descriptions of plants and animals he indicated that he was not aware of that particular information.

The user can know what kind of information is available by listening to the 'Guide' and by reading the textual 'Help'. The user has access to these facilities at any point. By selecting 'Info' the user gets 'Help' and 'Guide' options. 'Help' gives a textual help; 'Guide' takes the user to a short videoclip of the presenter. Usually users select 'Help' when they were stuck or did not understand an aspect of the program.

The above situations show the range of difficulties the farmers faced. To learn, they had to communicate with the program by means of the interface that comes between the learner and the program content, which is 'hidden' behind the screen. The user has to select the correct icon on the screen to reveal the part of the content that he or she wants. In order to do that the learner has to understand and be able to interpret the interface. This is crucial for better interaction with the program.

Program presents information

The Walk, the Office and a few links in the Plan provide the basic information necessary for making farm management decisions. During the session the farmers navigated through all these three sections. At times they were absorbing information silently while on other occasions they talked as they got more and more. They sometimes browsed the map and the Walk while at other times they read textual descriptions or listened carefully to videoclips. The pattern of interaction again pointed towards some important aspects of learning from the program.

Looking for more information

The farmers were keen to know if there was more information available. Martyn had been using the program for 12 minutes, including five minutes in the Walk, when he discovered that the map did not provide all the information he was looking for:

> Can you get any more information from the plan [the map]?

The map does not give a detailed description of the farm; it only shows the shape of the farm with field boundaries and north marked. When Martyn saw the map he was disappointed that he could not get information such as the size of the fields and the kinds of crops grown in each field. When I explained how to get a text description of each location on the farm, again he was not satisfied:

> ... It just tells you where we are

He explained the kinds of information he wanted for his learning task:

> The farm on the map, the whole farm, normally on the map field sizes, what the cropping is, you haven't got that? ...

From then onwards he looked at the textual descriptions of all the locations he was walking through and he tried to get relevant information he needed. He said that the information was not enough for him to make a proper management plan:

> (looking at the farmyard) ... Yes, farmyard, but it didn't say enough

He explained that the cropping history of each field, all the fields with their numbers and extent, and a breakdown of sources of income are necessary to do a proper farm management plan. He again summarised what he wanted to know:

> You need a farm map with the acreage on it, the size of the fields on it, and you need a history of cropping

Eventually he was able to get that information from the Plan section, towards the end of the learning session. He was working hard to investigate how to get that information. When he realised that he could get what he wanted to know, he was satisfied. By this time he had been working for more than four and a half hours with the material.

Martyn is an experienced farmer who knows what information is necessary for the learning task. Even though the program does not expect the user to do a proper farm management plan, he did not start planning until he had found all the information he needed, as he would do in his daily work. He browsed the material for four and a half hours until he found out how to get the information and then he took notes. Later he decided to do the plan on another occasion.

Similarly, when Neil was in the Plan section, making his farm management decisions, he felt he needed additional information:

> ... is it possible, for example to lease in and lease out, you really need to know current production, you just choose one of those, do you? Is there any other information?

Without this information he could not move ahead with his plan. So he chose to view the videoclip of the farm at this point. It was the third time he had watched it. This time he viewed the whole videoclip, lasting about 6 minutes. Throughout, he was very attentive, looking at his notes, comparing them when specific statistics were given. After the video he went back to the Plan to look at the list of actions, and thought about the next step.

Neil again wanted more information when he was in the Plan section making his farm management plan. He spent about a minute studying the range of options or management plans. Then within two minutes he made a series of selections leading to a decision. After nine screens he realised that he needed more information before proceeding. At this point he wanted to watch the video sequence again, and he did.

Being critical on the accuracy of information

When the learner was getting information from the program he not only read it but also attempted to see whether what was presented was correct. One instance was when Neil spotted the information given about a certain kind of bird:

> There is also another thing wrong here, it says 'starling, rare', well it is not rare. ... . I disagree with the ..., ... the information is dubious.

Within the Office, while getting information from the farm accounts, Neil spotted an error related to the number of cows:

> In the introduction, Poul Christiensen [i.e., the farmer who appears in the video] said it is 400 cows, but here only 240, there, so... .

Immediately afterwards Neil wanted to watch the videoclip, apparently to verify this information from a different source. He listened attentively and checked his notes while the video was giving the information. Satisfied, he stopped the videoclip. He did not listen to the whole section.

Martyn, too, was very keen on the accuracy of the information and commented a lot on this aspect. He used information from different sections of the program, i.e., the Walk, the Office and the Plan, in order to check the accuracy of information he was getting. Also he looked at information in different formats, i.e., videoclips, text and photographs.

The financial accounts give an overall idea about the whole farming operation. Having looked at them the user can see if other parts of the program give compatible information. When he was looking at the livestock figures in the Plan he pointed out that the figures were not correct:

> False information, nothing goes back to the ... .

Immediately he wanted to check on this. He returned to the Office and listened to the videoclip of the farmer who explains the whole farming operation. This videoclip gives figures of different enterprises including the livestock. When the video was giving information on the number of cows, he said:

> Well that doesn't tally, that doesn't tally with his accounts ... (looking at his notes again) has 240 cows.

At this point he wanted to stop the videoclip and watch again to clarify the figure. Then he viewed the whole videoclip. When the figures were given he took notes again; he was sure that the figures did not tally. He explained to me why he thought they were wrong. He analysed the gross margins figures coming from dairy cattle and pointed out that the income from milk suggested different numbers of cows. So he wanted to know whether someone had used the Disc, and changed the figures:

> I mean these figures are his figures (original figures), aren't they? Not somebody else's who has been doing this program? Figures are supposedly taken from that farm?

There were other occasions when he wanted to satisfy himself that information was correct. He made sure that the arable acreage and forage acreage were correct.

Once he was comfortable with the program, after more than an hour, Martyn became more critical of the kinds of information he was getting. He thought that three locations of the map gave the same description:

> We are getting the same picture, ..., in all three dots! ... Those three dots are all of the same report

He thought he noticed that the textual description was the same in three different locations. However, he wanted to check whether he was right. He again checked the locations and found that only two of them were giving the same description.

Having been in the Walk for nearly two hours he commented on the kinds of information he was getting so far:

> Ha! Doesn't seem to be a lot of co-ordination between the movements, something isn't right, I don't know whether it is all filmed on one farm or not.

Relate to own knowledge and experience

There were instances when the farmer was trying to relate the information he was getting to his experience of farm management. Especially when Martyn was commenting on the information, he based his arguments on his own knowledge and experience of farm management.

While getting information on different farm enterprises, he drew on his knowledge and experience of farm management. He spoke about the expenses of buying in quota, the need to know the cropping history in order to qualify for arable aid, etc:

> Because the biggest cost in maintaining dairy is buying in quota, you take all these accounts as they are... At the moment, for the lay of the land you got to have grass, you may be able to twig the acreage, you don't know what it's cropping history is, do you? Because you've got to consider, if you are thinking in today's climate when you've got the arable aid, if those fields weren't in grass in 91, then they are not eligible for arable aid.... So unless you have got an historical cropping or we're in an arable rotation they may have been in a temporary grass in 1991, they will qualify, but if they are in permanent pasture situation they wouldn't qualify... .

He went on to get more information he needed. During this time he was commenting on the information, while looking at its accuracy. His main comment was that the program did not give enough information to do a proper farm management plan. His comments were based on his knowledge and experience in farming:

> ... I wouldn't think land use wise you would change it a lot, it is obviously limited to how much arable you can grow, because of the land structure, but I want a break down of it, other than what's currently growing, there is no mention of maize which was seen on the film, obviously that come under forage acreage presumably, so not all that forage acreage is grass, in that maize ground you could grow cereal crops, or a possibility anyway, because he'd have to harvest it before it got too wet a ground because in autumn it will get too wet to get the crop off.
>
> It is growing more that 90 acres of cereal, so it is entitled to area A, but I would have thought the way it was styled wasn't far out, you could tinker with the edges of it. I don't think you'd structurally alter any of it.

Focused searching

The farmers searched the information in a very focused manner. There were a few instances when Martyn explained to me what he was looking for. The first time was when he came across a picture of the farm with a road and a house.

> That's what that was, I was wondering whether there was a road.

He was on the north boundary of the farm. He thought there was a road making the boundary of the farm and it proved to be true. That was the entrance to the farm.

The next time was when he was in the middle of the farm. When he saw the picture of the farmyard he looked very happy:

> Ahhaa!!! found it!!!

When I asked if he was looking for something, he said:

> Yes, I was looking for farmyard ... I didn't get it last time I got there.

Once he found out its location, he looked for information around that area for a long time, for instance he spent 10 minutes in the farmyard. He moved little by little around the same area looking for information related to the farmyard and farm animals. He wanted to know the kinds of animals in the farm, but felt that the textual description did not give him enough information. He wanted to see whether the 'Help' and 'Guide' gave more information, and explained to me what kinds of information ought to be incorporated into the map.

The process of information gathering within the Walk is more or less random – the user needs to go round the farm using the map and by clicking on the arrows at the bottom of the screen. Photographs and textual descriptions help him or her to see what is available at any particular point. Having done that type of search for 20 minutes, Neil wanted to know if there were direct ways of getting information from the program:

> Is it actually possible to find out, for example, if there is a pond there. I don't have to do it by random, sort of process. I can't say, 'list ponds', and it would find, tell me where the ponds are?

The users, being farmers with years of experience, were familiar with the resources and natural habitat available in a typical farm. Not being absolute beginners in farm management, they may well have wanted to save their time on gathering information.

Learner seeks more information

When the farmers were in different parts of the program there were instances where they were not happy with the kind of information they were getting. As discussed before they indicated that without additional information they could not move ahead with their plan, so they chose to go to other sections to get more information.

Program presents more information in various media

The program was able to present information in various media such as text, photographs, graphics, video and audio. The farmers accessed and compared information from different sources at different stages. When they were in the Plan they were getting more information from descriptive one page texts. Then they were able to cross check that information with information from the videoclip.

Learner makes inputs to the program

In the Plan section the user has to make farm management decisions, by taking financial and conservation aspects and views of the local community into account. There are 19 major areas where the user can make decisions ranging from landuse to managing a disused railway station on the farm. Each major area is divided into its own sub sections; the user selects one aspect which takes him or her to the next level and subsequently the next level and so on. The final step is to make the decision. Having made as many decisions as possible, the user needs to submit the management plan. As mentioned earlier, Martyn decided to work on the Plan section another time. Neil completed the Plan, and reflected and related to his own experience.

Reflection

The Plan section of the program requires the users to reflect on information they have got so far, in the light of their own experience, then make decisions. Neil spent 42 minutes in this section, as opposed to 27 minutes in the Walk and 32 minutes in the Office. He was not aware of the time limit we had agreed in the beginning; we agreed to spend two hours, but I had to remind him of the time.

In the Plan Neil looked carefully at the list of options, thinking and scratching his head. He did a few calculations on a calculator with his head bent towards the papers. This sequence of activities probably indicated deep processing of information received from the program. For about seven minutes, he did not change the screen.

After doing the calculations Neil was ready to draw up the plan; his first decision was made following four consecutive actions. Subsequently, he took a series of farm management decisions and submitted his plan. The time taken for making the plan after looking at the videoclip was 23 minutes, of which he spent about 13 minutes – more than half – in thinking, reading his notes and writing.

Relating to one's own experience

After the learning session Neil explained to me how he had made the farm management decisions. While he was processing information and making decisions he appeared to be referring back to his own experience. He was mainly a dairy farmer, and started off with the management aspects related to dairy management:

> ... my plan in the beginning was to drop all the beef. Because I didn't think they're profitable. And replace them with cows. And keep everything else as the same.

He carried on with the dairy management and tried to make some changes in the labour input assuming that the way he used to make such changes in his own work would apply to this simulation:

> ... see in theory I thought that the labour ..., I took out the beef, supposing the person who is working on the beef then go and work on the dairy. But it said I needed an extra labour unit. So I had to put one in.

What he meant by *in theory* was in fact his own farm management experience. The discussion afterwards showed that he always tried to draw on his own experience while making the management decisions.

Program gives feedback

The program gives feedback to the learner after he or she has submitted the farm management plan. After submitting, the Guide asks the user to go to the Office again and see the reaction of various interest groups towards the plan. While in the Office one can use the computer to check on the new financial status. Also the user can go back to the Walk and see the effects on the wildlife. The learner can decide whether he or she is satisfied with the plan or if it should be changed. Neil received feedback for his plan.

Reflection

After submitting his plan, Neil went to the Office and first looked at the gross margin, taking time to analyse the financial status. Then he selected estate finances and fixed costs. He spent time reflecting on the financial results of his management plan:

> I seem to have made less money. ...£4000 less. ... I looked at the balance sheet and the net worth. And the net worth was £4000 less.
>
> Basically the parlour and the extra labour unit wasn't covered by the extra cows. I basically replaced the beef with cows. Obviously I can play around and try and find an optimum ..., keep putting more cows in or something.

Neil was unhappy about the outcome of his plan, maybe because he had some years of farming experience.

He then received feedback from spokespersons for interest groups. First he selected the Trade Union representative who was unhappy about the plan. Neil wondered why because he had employed an extra worker in his plan. The second feedback was from the Wildlife Adviser who was also unhappy about the plan. Neil did not comment on him, perhaps because he had not taken the environment much into account. The next representative spoke for the National Farmer's Union: he also was not impressed with plan, commenting that it had not produced a healthy balance sheet. Neil made no comments on this. Finally Neil selected the District Council representative, who said that the plan caused *no concern* since it did not include any action that required permission. He could go ahead with his plan as far as the Council was concerned.

Learner modifies inputs

As Neil was receiving feedback on his inputs and showing the above reactions he was constantly modifying the inputs. He spent 11 minutes making changes to his plan.

Program gives feedback based on modified inputs

The program takes the user's modified actions into account and gives feedback accordingly. Feedback is presented the same way as before. The learner can again change his plan if he is not satisfied with it. Following were Neil's reactions.

Challenging the reasoning given for the feedback

The user gets instant feedback if he is about to make any unrealistic changes. The computer makes a sound and a short message appears at the top of the screen indicating why that particular action is impossible (more details in Chapter 3, section 3.4). The computer assesses the present situation on the farm and tells the user why that move was impossible. Neil got this feedback when he was making his original plan, too, but was not too worried about it. When he made his first modification, he said:

> ... (reading why it is not possible from the screen) 'insufficient arable labour for a dairy unit' ... But we don't need arable labour for dairy. So I can't understand what the ... , why that is.

At another bleep of the computer, he thought for a while why the computer had rejected his input, shook his head in disbelief and said:

> That is some ... , I don't know. The more intensive you do, the more you get out of it. That what I would have thought!

Challenging the nature of the feedback

As Neil was modifying his actions, the program rejected two of his actions, at which point he challenged the computer's feedback instead of just accepting it. When the computer rejected his input for the second time, he commented:

> So now here I think it should give you which are, because at the moment I am working my way through it, every time it says 'insufficient', I am changing it. What it should say is 'you need 20 more acres' or what ever, you know. ... I am just guessing, and it takes me a long time, doesn't it? I got to work out what these fields got in them.

He was concerned that the program did not give enough information about the farm's current state. He expected the program to tell him exactly how many labour units were needed, instead of telling him that the farm labour was not enough.

> ... rather than saying and giving you a list of things, and how, like saying, you know, you need an extra so much of space and this much will cost X amount. It doesn't tell you that, just keep doing. Even if you get it right *it doesn't tell you.*
>
> And the other thing is, say, you want to grow potatoes, it will probably say you don't have enough machinery, you haven't this, you haven't got that, you really want a whole list of what you haven't got or what you've got to change, and then how much it would cost or whatever, then that would give you ..., then you could decide immediately whether you want to proceed, where as this you got to proceed then you will find out it wasn't a good idea.
>
> What it could have done was in the list it could have said to you require X amount of heifers, you've only got Y, you know, you have only got 240, but you actually require 360 or something.

Challenging the quality of the feedback

Just before finishing the learning activity, Neil was listening to the National Farmers' Union representative's comments on his management plan. The person said that the plan had real problems. He laughed loudly and said:

> He hasn't told what the problems are. See that is ... (pointing to the screen). He says there is a problem. So I can go back to my balance sheet. But what is the problem? It always needs highlighting. Have I spent too much capital? Have I got too many people? My private drawings too high? (laughter). The feedback is not enough.
>
> It doesn't tell me what they are at the moment.
>
> You get a new balance sheet ..., you don't know how it's been arrived, you don't know whether it was a ... of a better gross margin, or whether it was less fixed cost, or whether it would have been better if you could have reduced fixed cost.

Neil wanted the program comment to be more specific, to say exactly why his farm management plan was unacceptable.

The program is based on the model built into it, which includes assumptions about the complex interrelationships between individual farm management decisions and financial profitability, the conservation and local economic aspects. The user often has his own farm management model, based on formal and non-formal learning about farm management as well as years of experience of farming. He or she probably has convictions that he or she does not want to change just because the computer program says so. Neil expected the program to give specific reasons why certain decisions were unacceptable. He also wanted the program to behave as an advisor, giving suggestions rather than telling him that he could not make certain selections.

5.3 Summary of the analysis

The data analysis so far has attempted to pin-point what went on while the farmers were using the program. There was a range of activities between them and the program, and within each activity, some important aspects that have implications for learning were observed. From the beginning the learners experienced navigational problems, making it one important aspect that dominated the early interaction between the learner and the program. Three other aspects – how the learners went about getting information, how they made decisions and how they evaluated results – can be summarised under the umbrella of learning style. These two main aspects, namely the learning style and learner's navigational problems, were identified from the pilot study for further scrutiny. Fig. 5.3 summarises the data analysis.

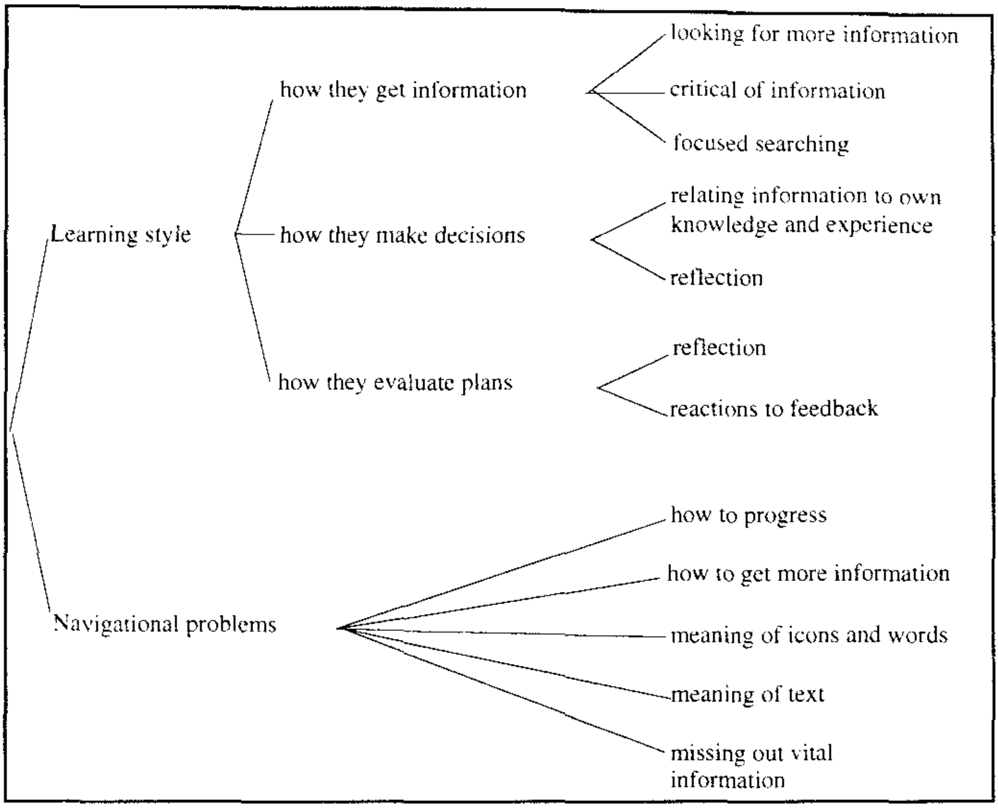

Fig. 5.3: A summary of the data analysis of the pilot study

5.31 Learning style

This refers to the manner in which the learners used the program in order to achieve the learning task. The learning style has three aspects: how the learners went about getting information, how they made decisions and how they evaluated their plans.

How the learners got information from the program

Important observations while the learner was getting information from the program:

- The learner looked for more information to do the learning task. He knew the kinds of information necessary for the learning task, because of his experience in farming.
- The learner was critical of the information presented. He wanted to verify the information presented by the program. While getting information, he continually cross-checked to see whether the information was correct.
- The learner accessed the information in a very focused manner. He was familiar with the resources on a farm so he knew where to go and what information to look for.

How the learners made decisions for their management plans

Important observations while the learner was making decisions:

- The learner related the information to his own knowledge and experience when doing the learning task
- The learner reflected on his or her action and possible outcomes.

How the learners evaluated results of their farm management plans

Important observations while the learner was evaluating his plans:

- The learner reflected on the results in the light of feedback
- The learner reacted to the feedback in various ways. For instance, the learner challenged:
  - — the reasoning given for the feedback
  - — the nature of the feedback
  - — the quality of the feedback

The main study therefore focuses particularly on observing these instructional interactions in order to understand more about how farmers learn from computer-based media.

5.32 Learners' navigational problems

The learners encountered a range of difficulties when using the program. Some they overcame independently, but occasionally my intervention was necessary. They had difficulties in understanding:

- how to use the interface to progress, especially in new sections
- how to use the interface to get more information, even though they knew that the information was available in the program
- the meaning of icons and words within the interface
- the meaning of text on screens
- that vital information was available (so they missed it).

Learning with a computer-based medium was a new experience for the farmers. Since they had to click on the correct icon to reveal the desired content, they needed to understand and be able to interpret the interface which was comprised of icons and abstract words on the screen. Some problems observed were probably due to the learners' inexperience with the interface. Others may have been due to poor interface design, such as the use of ambiguous words on the screen. These learner-interface interaction problems will be explored further in the main study.

5.4 Conclusions

The pilot study investigated how farmers learn from the selected computer-based program, The Countryside Disc, and identified the important categories to be studied in the main field work: the learning style and navigational problems. Fig. 5.4 depicts the activities between the farmer and the program during the learning process, and highlights the important aspects within each activity.

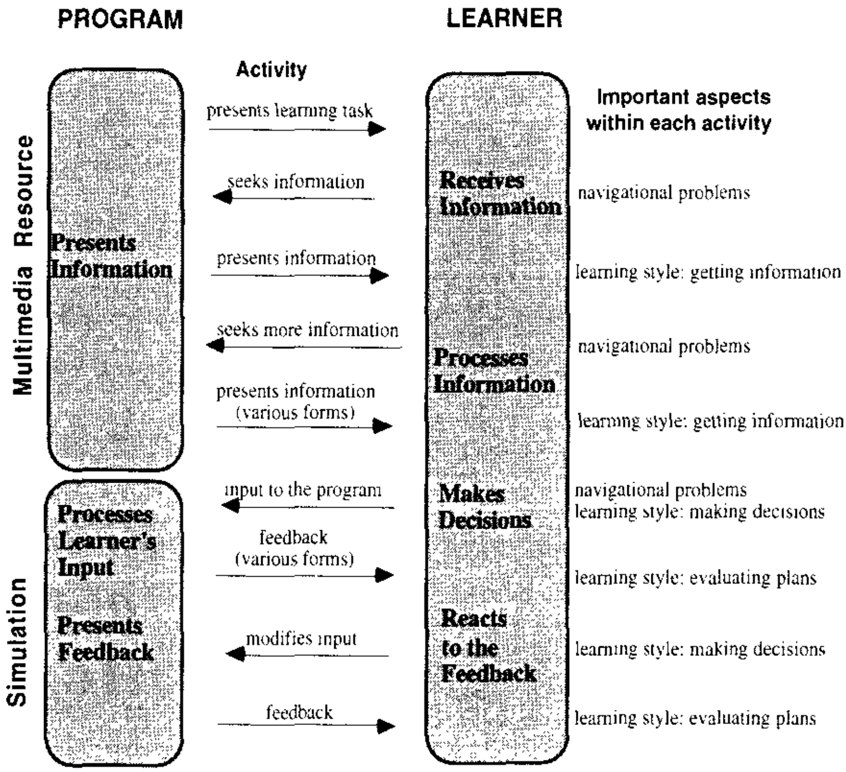

Fig. 5.4. The pattern of interaction between the farmer and the program

Towards the left of the diagram are the activities between the program and the user. Towards the right of the diagram are the important observations within each activity. With modifications, this framework was used as a working model for the main study. Ten farmers were used in the main study and at least one week was allowed for them to learn from the program. Chapters 6, 7, 8 analyse data of the main study, pertaining to the learning style, one category identified from the pilot study. The next chapter, Chapter 6 analyses how the individual farmers got information from the program.

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Chapter 6
The main study: the farmers getting information

Chapter 6 is the first of three chapters that analyse main study data pertaining to learning style (Section 4.3 of Chapter 4 describes the methodology, data collection and analytical framework of the main study). This chapter looks into how the farmers went about getting information from the program. First, the chapter begins by describing the set of criteria, called indicators of learning, used to measure each farmer's effort to learn from the program. Second, it goes on to analyse how each farmer obtained information from the program. Based on this analysis, the chapter finally shows the evidence of differences in individual farmers' approaches to learning from the program.

6.1 Indicators of learning

The Walk, the Office, and some links in the Plan function as the multimedia resource of the program, providing information necessary to farmers. Farmers were free to decide how they would go about getting information from each section, and were free to decide how much time they wanted to spend in each section. In order to analyse their approach to learning from the multimedia resource, it is necessary to select criteria that indicate how they went about getting information from each of the three sections. These indicators are based on how deep and detailed their navigation was.

6.11 Indicators of learning from the Walk

The Walk is the section where the user walks around the farm and gets information necessary for making farm management decisions. The user can access information about the farm at different levels. For instance, the user can just move around the farm and do a 'brisk walk'. This could be considered as basic level navigation. Alternatively the user can not only move from one location to another, but also go to a deeper level and investigate each location in detail. It is possible to categorise these different levels of investigation, and use them to analyse how each user obtained information and learned from the Walk. Different types of navigation and time spent on the Walk would be used as indicators of learning from the Walk.

Time spent

The first indicator would be the time spent on the Walk section. The farm depicted in the program is about 400 hectares, further divided into 47 fields. There are many features on the farm such as farmyards, barns, woodlands, a river, ditches, ponds, a disused railway station as well as arable crops, grasslands and livestock. In order to understand more about the farm, users need to walk to these locations and access photographs and textual descriptions, which takes considerable time. Therefore, the time spent on the Walk section during the first learning session would be an indication of each user's effort to understand the section.

Level-1 type of navigation

This is the basic level where the user moves from one location to another using the map. At each location he or she may select 'Description' from the bottom menu bar. The user can see a photograph and a brief description of the location. The information includes the soil type, the present cropping and other special features of the location. Afterwards the user may select 'Map' from the menu bar and move to another location. This type of navigation allows the user to do a 'brisk walk' around the farm. The objective of this type of navigation is to get a general understanding of the farm, quickly.

Level-2 type of navigation

At the second level the user uses arrows at the bottom left hand corner of the screen to walk. This kind of walk allows the user to see more details of the location selected. Also the user may get panoramic views of the location by clicking on left or right of the screen continuously. After doing this kind of investigation, the user may normally use the map to move to a new location. Alternatively he or she may use the same arrows to carry on with his or her walk. The objective of this type of navigation is a closer examination of the locations selected.

Level-3 type of navigation

At the third level, the user may look at lists of wildlife species present at any location. The typical moves would consist of: selecting a new location; accessing a photograph and reading a description of the location; and finally selecting 'Plants' or 'Animals' on the menu bar to access a list of wildlife for that location. Afterwards the user may move to a new location and repeat the same procedure. The objective would be to do a brief investigation of a special feature, i.e., wildlife.

Level-4 type of navigation

At this level, having done the moves mentioned above, the user may look at photographs and textual descriptions of individual plants and animals at any location.

These four levels of navigation can be used to identify the intensity of an individual's information gathering. Navigation that is mostly level-1 type allows a user to move faster from one section to another. The user can look at a photograph and a textual description of the field being observed. However, you cannot see the surroundings of the area, nor the adjacent fields if you stick to the level-1 type of navigation. A detailed investigation of locations is only possible with a level-2 type of navigation. The user would use arrows to walk around and look at a panoramic view of the location. So a more intensive information gathering would be characterised by a level-2 type of navigation coupled with a level-1 type. The next two types, level-3 and level-4 types of navigation would allow the user to focus on each field to study the wildlife.

It is not possible to assess how far each of these individual levels of navigation and the time spent contribute to the user's understanding of the farm and eventually influence his or her decisions regarding the final farm management plan. You cannot categorically state that looking at more of the individual photographs of wildlife would help you to understand more about the farm as a whole. If you do that kind of search all the time, it limits the time available to visit other locations. However, it is reasonable to say that the degree of understanding of the farm is reflected in a combination of factors such as the total time spent on the learning task, the number of locations visited, the number of locations studied in depth, etc. It is not possible to state categorically how much each component contributes to the final learning outcome, but it is reasonable to say that a better understanding of the farm could be obtained by:

- spending more time on the task within the Walk
- visiting more fields (level-1)
- walking around and taking panoramic views of more fields (level-2)
- looking at a reasonable number of wildlife examples (level-3 and level-4)

6.12 Indicators of learning from the Office

The Office is the section where the user could get more information about the financial situation and the background of the farm, listen to opinions of the interest groups and read case studies based on some of the farm management activities. Two basic indicators of learning are used in this analysis.

Time spent

The first indicator would be the time spent in the Office section, consisting of four items giving further information about the farm. When selected, each item would either play back a videoclip or a page of information. It takes considerable time to go through these sections and get information. So the time devoted to the Office during the first learning session would be considered as an indication of each user's effort to learn from this part of the multimedia resource.

Number of sections covered

The second indicator of learning would be the number of sections covered. This consists of the total number of videoclips viewed and textual pages read by the user.

6.13 Indicators of learning from the Plan

The Plan provides detailed information related to more than 100 farm management activities possible for the farm. Five indicators are used to get some understanding of their approach to learning from the Plan section.

Time spent

The first indicator would be the time spent on the Plan section. As it consists of more than 100 farm management decisions grouped into 19 major categories that are further branched into various levels, it takes some time to understand how to work through the Plan section. So the time spent on the Plan section during the first learning session would be an indication of each user's effort to understand the section.

The number of categories studied

The second indicator would be the number of categories each user investigated on the first day. Each category consists of different types of actions and going through more categories means getting a better understanding of the possible actions for the future management of the farm.

The number of pieces of information sought

The third indicator would be the number of pieces of information sought. The user could access a piece of textual information for all the actions at all levels. For instance, by selecting each house within the farm, the user could read a page of text about its location, special features, current usage and potential uses. By selecting each field the user could read a text that gives information such as its size, current cropping and its possible uses. All this information is necessary to know more about the farm and the assumptions built into the program. The program usually suggests that the users should read these pieces of information especially if an action is rejected by the program. So, reading additional information provides a better insight into the farm.

The number of 'actions' selected

The fourth indicator of learning would be the number of times each user tried to make farm management decisions, i.e., the number of actions selected. In order to make decisions, the user needs to go through the different levels of each category and reach the last level. By this time the user would have read all the possible actions for that category.

The number of plans submitted

The fifth indicator would be the number of times each user submitted a plan and listened to the feedback. Submitting a plan means completing a set of actions, possibly only a few in the beginning. Trying to listen to the feedback implies a desire to know more about how the Plan works and to know the consequences of the actions chosen.

6.2 Approach to learning

6.21 Within the Walk

Pattern of getting information

The indicators of learning discussed under 1.1 are used to analyse individual users' approach to learning from the Walk. The observation data showed a mixture of the above four levels. All the users moved around the farm and all of them chose to look at photographs and textual descriptions of wildlife. However, a closer analysis of their navigation patterns shows distinctive biases towards one type of navigation or another. Some users were doing more of 'brisk walks' around the farm whereas others were interested in investigating each of the fields they visited. These differences are discussed below.

Martyn

Table 6.1 summarises Martyn's pattern of navigation within the Walk. The first main column shows the time each action occurred and the second the different levels of navigation. The second main column is further divided into four columns, each recording the four levels discussed above (Tables 6.1 - 6.8 have the same structure and summarise each user's pattern of investigation).

Table 6.1: Martyn's pattern of navigation within the Walk section

Time	Different Levels of Navigation			
	Level-1	Level-2	Level-3	Level-4
0.04.32	map, moves to F28, reads description	walks around, reads description		
0.11.00	map (F27), moves to F2, reads description			
0.13.07			plants	
0.13.44	map (F2), moves to F3, reads description			
0.15.45			plants	
0.16.06			animals	
0.16.40	map (F3), moves to F4, reads description			
0.17.39	map (F4), moves to F6, reads description	walks around		
0.34.58	map, moves to F14, reads description	walks around		
0.48.38	map (F14), reads description			
0.50.27			plants	
0.50.41			animals	
0.51.08	map (F14)	walks around		
1.30.26	map (F47), moves to F46, reads description	walks around (8 times)		
1.33.24	map, moves to near F46, reads description	walks around		
		looks around (16 times)		
1.37.52		walks around (2 times)		
1.38.45		looks around (7 times)		
1.40.17	map (F32), moves to near F46	walks around (3 times)		
1.42.20	map (F47), moves to near F46, reads description	walks around (14 times)		
1.46.27	map (F46), moves to F44, reads description	walks around, reads description		
1.48.28	map (F44), moves to F40, reads description	walks around, reads description		
1.50.58		walks around, reads description		
1.52.11	map (F38), moves to F40, reads description			
1.52.50			plants	
	map (F40)	walks around (10 times), reads description		
1.55.48	map (F11), reads description			
1.57.42	map (F3)	walks around (16 times), reads description		
2.00.19	map (F44)	walks around (2 times), reads description		
2.01.11	map (F44), reads description			
	map	walks around (2 times), reads description		
2.03.54	map (F42)	walks around		
2.04.59	map (F42)	walks around		
2.06.48	map (F42)	walks around (3 times), reads description		
2.08.03	map (F39), reads description, moves to F28, reads description	walks around		
2.10.58	map (F28), reads description	walks around, reads description		
2.12.24	map (near F28), move to F26, reads description			
	map (near houses)	walks around (4 times), reads description		
2.14.29	map (F26)	walks around		
2.15.27	map (F25), reads description	walks around (2 times), reads description		
2.17.41	map (F26), moves to F'myard 1, reads description	walks around (9 times)		
		looks around (8 times)		
2.19.45		walks around (5 times)		
		looks around (9 times)		
		walks around		
		looks around (8 times)		
2.21.26		walks around		
2.21.39	map (F20), moves to village, reads description	walks around (14 times)		
	map	looks around (7 times)		
2.23.53		walks around (5 times)		
2.24.17	map (north), moves to F'myard 2, reads descript.	walks around (2 times)		
		looks around (8 times)		
		walks around (5 times)		
		looks around (15 times)		
2.27.12		walks around (2 times)		
		looks around (13 times), reads description		
2.28.32	map (North), reads description, moves to farmyard 1, reads description			
2.30.48			plants	
2.31.07			plants	
		looks around (12 times)		
2.33.16		walks around		

In the table, both Level-1 and -2 columns contain entries, suggesting that Martyn's pattern of navigation consist of both level-1 and level-2 types. A closer look at the table shows the details. Martyn started by using the map to move to a new location and reading the location description. He then walked around the new location using arrows, and read a description. This pattern is a combination of level-1 and level-2 types. He then used the map to move to a new location and looked at lists of wildlife, hence a level-3 type navigation. Afterwards, Martyn appeared to have settled for a navigation pattern that consisted mainly of two types. First is the combination of level-1 and level-2 types, the way he started to navigate the Walk. Second is the level-2 type, looking around the farm by clicking on left and right of the screen, and walking around the selected locations using arrows. Both these types enable the user to walk around the farm with much observation. Martyn walked to 20 fields on the farm. Following is the summary of different levels of navigation:

Level-1	4 times
Level-2	20 times
Level-1 and Level-2	21 times
Level-3	8 times
Level-4	0 times
Number of fields visited	20 fields

Martyn's navigation within the Walk is dominated by level-2 type and a combination of level-1 and level-2 types. There were only four instances of level-1 type walks. These figures suggest that Martyn was interested in a 'deep' approach to getting information from the Walk (see Chapter 9).

<u>Tim</u>

Table 6.2 summarises Tim's pattern of navigation within the Walk.

Table 6.2: Tim's pattern of navigation within the Walk section

Time	Different Levels of Navigation			
	Level-1	Level-2	Level-3	Level-4
0.04.53	reads description			
0.05.18			plants	
0.05.53	map (F47)			
0.09.26	map (F47), moves to F28, F30, F31, reads description			
0.10.25			plants	
0.11.30			plants	
0.11.44	map (F31), moves to F17, reads description			
0.12.26			plants	
0.12.52			animals	
0.14.05	map (F31), moves to F15, reads description	walks around (12 times)		
		walks around (9 times)		
0.25.54	map, moves to F23, reads description			
0.27.09	map (F23), moves to F20, reads description	walks around (11 times)		
0.28.38	map, moves to Farmyard 1, description			
0.29.06	map, moves to F12, reads description			
0.29.44	map (F12), moves to Farmyard 1, reads description			
0.30.17			animals	
0.30.45	map (F12), moves to farm house, reads description			

0.31.17	map, moves to F29, reads description			
0.32.06	map (F29), moves to F38, reads description			
0.32.37			animals	
0.33.13			plants	
0.33.33				photo + text
0.34.02			plant	
0.34.08	map (F29), moves to F22, reads description			
0.35.06			plants	
0.35.25				photo + text
0.36.01			plants	
0.36.07	map (F22)			
0.39.00	map (F22), moves to F45, reads description			
0.39.38			plants	
0.40.00				photo + text
0.40.19			plants	
0.40.25	map (F45)			
0.44.10	map (F45), moves to F11, reads description			
0.44.55			animals	
0.45.18				photo
0.45.28			animals	
0.45.33	map (F11), moves to F13, reads description			
0.46.07	map (F13), moves to F14, reads description			
0.46.35	map (F13), moves to F16, reads description			
0.47.19	map (F16)			
0.48.02	map (F16), moves to F26, reads description	walks around (3 times)		
		looks around (6 times)		
		walks around (3 times)		

Table 6.2 contains more entries in Level-1 column than in Level-2 column, suggesting that Tim's pattern of navigation is dominated by level-1 type. In the beginning Tim started to look at lists of wildlife as he moved from one location to another using the map. When he was shown how to use arrows to walk around (the level-2 type of navigation, at 0.14.05) he used it a couple of times. Afterwards he stuck to moving from one location to another doing the 'brisk walk' (level-1 type, from 0.28.38). At the next four locations he kept looking at the photographs of individual wildlife (0.32.06; 0.34.08; 0.39.00; 0.44.10). Then he moved locations without going into details (from 0.45.33). He used arrows and a panoramic view once just before completing the task within the Walk (0.48.02). Tim walked to 17 fields out of the 47 on the farm.

The four levels of navigation could be used as a guideline to analyse whether Tim's navigation was a detailed one or just a surface level browsing one. Following is the summary of different levels Tim adopted:

Level-1	15 times
Level-2	3 times
Level-1 and Level-2	3 times
Level-3	4 times
Level-4	4 times
Number of fields visited	17 fields

Tim's navigation is characterised by many instances of level-1 type of navigation. There were only a few level-2 type. Tim was doing 'brisk walks' rather than looking more closely into each field he visited. Tim demonstrated a 'surface' approach to getting information from the Walk (see Chapter 9).

Steven

Table 6.3 is the summary of Steven's navigation within the Walk.

Table 6.3: Steven's pattern of navigation within the Walk section

Time	Different Levels of Navigation			
	Level-1	Level-2	Level-3	Level-4
0.27.35		walks around (25 times)		
0.31.38	map (F19)			
0.35.13	reads description			
0.35.36	map (F19)			
0.37.19	reads description	walks around (6 times), reads description		
		walks around (2 times), reads description		
0.39.15	map (F19)	walks around (6 times)		
0.40.45	map (F46)	walks around (12 times)		
0.42.19	map (F47)	walks around (7 times)		
0.43.29	map (F33)	walks around (3 times)		
0.44.35	map (F21)	walks around (5 times)		
0.45.34	map (F1)	walks around (10 times)		
0.46.48	map (F10)	walks around (7 times)		
0.47.48	map (F10)	walks around (8 times)		
0.48.54	map (F10)	walks around (5 times)		
0.49.47	map (F10), moves to north west	walks around (3 times)		
		looks around (once)		
0.51.21	map (F11), moves to Farmyard 1	walks around (8 times)		
0.52.41	map, move to F13	walks around (18 times)		
0.55.17	map (F13), moves to F28	walks around (5 times)		
0.56.34	map F30, moves to Farmyard 1			
1.01.32			plants	
1.02.16	map F 47, moves to central-south			
1.02.51			plants	
1.03.19	reads description			
1.03.35			plants	
1.03.57				photo + text
1.04.58			plants	
1.05.22				photo + text
1.06.27	map (F18), moves to F11			
1.07.06			plants	
1.07.29				photo + text
1.07.52			plants	
1.08.09				photo
1.08.37	map (F11), moves to F14			
1.09.18			plants	
1.09.52				photo
1.10.04				text
1.10.19			plants	
1.10.30				photo + text
1.10.47			plants	
1.10.56				photo + text

According to Table 6.3, Steven's pattern of navigation within the Walk shows four distinctive phases. It is a mixture of all four types of navigation. During the first phase (from 0.27.35 - 0.48.54) Steven started with a level-2 type of navigation – he used arrows to move around. Then he accessed the map to see his location. Afterwards he continuously used arrows to walk around the farm. In the second phase (from 0.49.47 - 0.55.17) he used the map to change his locations. However, he coupled the map together with the arrows, thus doing both level-1 and level-2 types of navigation together. In this way he moved from one location to another by using the map, and he used arrows to do an in-depth investigation of each field. The third phase, just one incident, began when he started to look at a list of wildlife after he had moved to a new location (0.56.34). This is a level-3 type of navigation. The last phase started when he looked at photographs and textual descriptions of wildlife of the next three fields visited

(1.02.16). This is level-4 type of navigation. Steven walked to 16 fields out the 47 fields on the farm. Following is the summary of his navigation:

Level-1	4 times
Level-2	12 times
Level-1 and Level-2	4 times
Level-3	1 times
Level-4	3 times
Number of fields visited	16 fields

Steven's walk was dominated by level-2 type of navigation, i.e., he was looking at details of the locations he visited. This approach to getting information could be characterised as a 'deep' approach (see Chapter 9).

Robert

Table 6.4 shows a summary of Robert's pattern of navigation.

Table 6.4: Robert's pattern of navigation within the Walk section

Time	Different Levels of Navigation			
	Level-1	Level-2	Level-3	Level-4
0.44.20				
0.44.36	reads description			
0.45.03			plants	
0.45.23			animals	
0.46..20	reads description			
0.46.28	map, moves to F30, reads description			
0.47.43			animals	
0.48.10	map, moves to F45, reads description			
0.48.53			plants	
0.49.18	map (F45)			
0.49.31			plants	
0.49.53				
0.51.01	map (F45), moves to F18, reads description			
0.51.37	map (F18), moves to F46, reads description			
0.51.59	map (F46), moves to F32, reads description			
0.52.25	map (F32), moves to F30, reads description			
0.52.44	map (F30), moves to west, reads description			
0.53.08	map (west), moves to F19, reads description			
0.54.01	map (F19), moves to F10, reads description			
0.54.31	map (F10), moves to F9, reads description			
0.54.52	map (F9), reads description			
0.55.10	map (F9), moves to F5/7, reads description			
0.55.34	map (F5/7), moves to F4, reads description			
0.56.10	map (F4), moves to F3, reads description			
0.56.50	map (F3), moves to F2, reads description			
0.57.15	map (F2), moves to near rail station, reads description			
1.00.30	map (near railway), moves to nr rail st, reads description			
1.01.09	map (north , moves to north, reads description			
1.01.44	map (north), moves to Farmyard 1			
1.02.46	map, moves to F11, reads description			
1.03.19	map (F11), moves to North East, reads description			
1.03.46	map (F15), moves to F15	walks around (13 times)		
		looks around (11 times)		
1.07.37	map, moves to F13, reads description			
1.08.05	map (F13), moves to F14, reads description			
1.08.28	map (F14), moves to F13, reads description			
1.08.43	map (F13), moves to F12, reads description			
1.08.59	map (F12), moves to F20, reads description			
1.09.22	map (F20), moves to F22, reads description			
1.09.51	map (F22), moves to F28, reads description			
1.11.11	map (F28), moves to F20, reads description			
1.11.34	map (F20), moves to F25, reads description			
1.11.51	map (F25), moves to F25 north, reads description			
1.12.11	map (F25 north), moves to F27, reads description			
1.12.44	map (F27), moves to F39, reads description			
1.13.04	map (F39), moves to F39 north, reads description			
1.13.24	map (F39), moves to F38, reads description			
1.13.47	map (F38), moves to F33, reads description			
1.14.12	map (F33), moves in F33, reads description			

1.15.55	map (F33), moves in F33 north, reads description			
1.16.24	map (F33 north), moves to F34, reads description			
1.16.49	map (F34), moves to F35, reads description			
1.17.12	map (F35), moves to F37, reads description			
1.17.53	map (f37), moves to F40, reads description			
1.18.15	map (f40), moves to F41, reads description			
1.18.35	map (f41), moves to F42, reads description			
1.18.58			animals	
1.19.22				photo
1.19.59	map (F42), moves in F42, reads description			
1.20.22	map (F42) , moves to F28, reads description			
1.21.03	map	looks around		
		walks around		
		looks around (9 times)		
		walks around (3 times)		
1.25.07	map	walks around (6 times)		
1.26.57	map (F43)	walks around (4 times)		
1.27.57	map (F30)	walks around (4 times)		
1.28.55	map (F15)	looks around (8 times)		
		walks around (3 times)		
		looks around (7 times)		
1.31.12	map	walks around		
1.31.41	map	walks around(3 times)		
1.32.20	map (F19)	walks around (3 times)		
1.32.55			plants	
1.33.14				photo
1.33.32	map	walks around (4 times)		
1.34.17	map	walks around (2 times)		
1.34.50	map, moves to F10	looks around (4 times)		
		walks around (3 times)		
1.35.55	map	walks around (2 times)		
1.36.29	map (F7)	walks around (3 times)		
1.37.01	map (F15)	walks around (3 times)		
1.37.42	map (F11)	walks around (3 times)		
1.38.15	map (F20)	looks around (2 times)		
		walks around (2 times)		
1.38.45	map (F20)	walks around (2 times)		
1.39.21	map (F27)	looks around (2 times)		
		walks around (2 times)		
1.39.59	map	arrows (3 times)		
1.40.29	map	looks around (8 times)		
		walks around		
		looks around (7 times)		
1.41.41	map	walks around		
1.42.26			plants	
1.43.02				photo
1.43.13			plants	
1.43.20				photo
1.43.41	map			

Robert started with a level-3 type of navigation – as soon as he went to the Walk section he went directly to look at the list of plants and animals. The next move was to look at photographs of wildlife, thus a level-4 type of navigation (0.49.53). After these two instances, he continued his walk with a level-1 type of navigation, i.e., doing a 'brisk walk' around the farm (0.51.01). However, towards the middle of this phase he did a level-2 type of navigation once (1.03.46). After being in the Walk for nearly 34 minutes he started to do a level-2 type of navigation, i.e., to use the arrows to do the walk and to look at the panoramic views of the farm (1.21.03). In between there were three instances when he looked at details of wildlife, a level-4 type of navigation. Robert visited 37 out of the 47 fields on the farm. Following is the summary of his navigation:

Level-1	44 times
Level-2	31 times
Level-1 & Level-2	3 times
Level-3	1 times
Level-4	4 times
Number of fields visited	37 fields

The above analysis shows that Robert's walk is characterised by both level-1 and level-2 types of navigation. There were 44 instances of level-1 type and 31 instances of level-2 type. Thus it is both a 'brisk walk' and a 'detailed' one. This is a combination of both 'deep' and 'surface' approaches to getting information.

Neil

Table 6.5 shows Neil's pattern of navigation within the Walk.

Table 6.5: Neil's pattern of navigation within the Walk section

Time	Different Levels of Navigation			
	Level-1	Level-2	Level-3	Level-4
0.10.54	map (F47), move to F35, reads description			
0.12.32			plants	
0.13.01				photo + text
0.13.29			plants	
0.13.38				photo + text
0.14.27	map (F35), move to F4, reads description			
0.15.02			plants	
0.15.24				photo + text
0.15.42			plants	
0.15.53				photo + text
0.16.05			plants	
0.16.20				photo
0.16.25			plants	
0.16.31				photo + text
0.16.49			plants	
0.16.55				photo
0.17.01			plants	
0.17.10				photo
0.17.24			plants	
0.17.32				photo + text
0.18.07			plants	
0.19.03			animals	
0.20.57	map (F4), moves to F37, reads description	looks around (9 times)		
0.22.53			animals	
0.23.31				photo + text
0.26.52	map , moves to F39, reads description			
0.30.17	map, moves to F5			
0.31.00			animals	
0.31.59	map, moves to nr rail station, reads description			
0.32.47	map, moves to nr rail station, reads description	looks around(6 times)		
0.34.46	map, moves to nr rail station	looks around (7 times)		
0.35.48	map, moves to nr rail station	looks around (8 times)		
0.36.34	map, moves to nr rail station	looks around (8 times), reads description		
0.39.30	map, moves to F21, reads description	looks around (6 times), reads description		
0.40.32			plants	
0.40.58				photo + text
0.41.21		walks around (2 times)		
0.41.34	map, moves to F21	walks around		
0.42.36			plants	
0.43.06				photo + text
0.43.34			plants	
0.43.47				photo + text
0.44.15			plants	
0.44.28				photo
0.44.35			plants	
0.44.52				photo + text
0.45.12			plants	
0.45.21				photo + text
0.45.48			plants	
0.45.57			animals	
0.46.19				photo + text
0.46.46			animals	
0.46.53				photo + text
0.47.53			animals	
0.48.00				photo + text
0.48.21			animals	
0.48.26				photo + text
0.48.45			animals	
0.48.50				photo + text
0.49.12			animals	
0.49.18	map, moves to F25, reads description			

0.50.26			animals	
0.52.33				photo + text
0.52.48			animals	
0.52.54				photo + text
0.53.16			animals	
0.53.23				photo + text
0.53.43			animals	
0.54.02		looks around (8 times)		
1.10.10	map, moves to F20, reads description	looks around (8 times)		

Neil started with a level-4 type of investigation. After moving to a new location he directly went on to look at the photographs of individual examples of wildlife. This detailed investigation of wildlife is predominant in Neil's way of getting information from the program. After looking at wildlife in two fields, he moved to another place and took a panoramic view of the farm followed by a level-3 type of navigation, i.e., looking at the list of wildlife in the field selected (0.20.57). The next phase is characterised by a combination of level-1 and level-2 types of navigation (0.26.52 - 0.39.30). This was followed by three instances of level-4 type of navigation. The last move was again a combination of level-1 and level-2 navigation. Neil visited 9 out of the 47 fields on the farm. Following is the summary:

Level-1	5 times
Level-2	0 times
Level-1 & Level-2	9 times
Level-3	1 times
Level-4	6 times
Number of fields visited	9 fields

Neil's pattern of navigation within the Walk is characterised by more level-4 types of navigation. He seems to be more interested in investigating the kind of wildlife at each location he visited. So, as far as studying wildlife he took a 'deep' approach. However, as a result of this, he could investigate only a few fields.

Duncan

Table 6.6 shows Duncan's pattern of using the Walk.

Table 6.6: Duncan's pattern of navigation within the Walk

Time	Different Levels of Navigation			
	Level-1	Level-2	Level-3	Level-4
0.59.12		looks around		
		walks around (6 times)		
		looks around (10 times)		
		walks around		
1.02.16	map			
1.02.58			plants	
1.03.31				photo
1.04.09				photo + text
1.05.16				photo + text
1.06.04				photo + text
1.06.26			plants	
1.06.42			animals	
1.07.11				photo + text
1.08.11		walks around (6 times)		
1.09.41	map (F35), moves to F13			
1.10.37			plants	

1.11.07				photo + text
1.11.34				photo + text
1.13.27			plants	
1.13.42				photo + text
1.14.35			plants	
1.14.41				photo + text
1.15.53	reads description for F14			
1.16.05	map (F14)			
1.16.53			animals	
1.17.32				photo + text
1.17.57			animals	
1.18.06				photo + text
1.18.54	map (F14), moves to F18, reads description			
1.19.51	map (F18), moves to F18 north, reads description			
1.20.31			plants	
1.21.09				photo + text
1.21.48			plants	
1.22.16				photo + text
1.22.35			plants	
1.22.46			animals	
1.23.13				photo + text
1.23.31			animals	
1.23.55	map (F18), moves to F5, F6, F7, reads description			
1.24.59			plants	
1.25.26				photo + text
1.25.56			animals	
1.26.20				photo + text
1.26.50	map, moves to Farmyard 2, reads description			
1.29.13		walks around		
		looks around (8 times)		
1.30.09	map (Farmyard 1), moves to F26	looks around (6 times), reads description		
		walks around(2 times)		
		looks around (4 times)		
		walks around		
		looks around (3 times)		
1.34.56	map (F26), moves to F33, reads description			
1.35.54			plants	
1.36.12				photo + text

Duncan started with a level-2 type of navigation. He used the arrows to walk with much observation, clicking on left and right of the screen to get a panoramic view. Afterwards he looked at a number of photographs and textual descriptions of plants and animal species present at that location. Then he used arrows to move to another location followed by looking at more plants and animals. Then he switched to a level-1 type of navigation, repeated four times, but at each location he looked at details of wild life, thus conducting a level-4 type of navigation. The last phase of his walk is characterised by a combination of level-1, level-2 and level-4 types of navigation. Duncan visited 13 out of the 47 fields on the farm. Following is the summary:

Level-1	5 times
Level-2	9 times
Level-1 and Level-2	2 times
Level-3	0 times
Level-4	6 times
Number of fields visited	13 fields

The above analysis shows Duncan as doing more detailed walks around the farm. Also he was interested in looking at individual wildlife at the locations he visited. Thus his approach to getting information could be classified as 'deep'.

<u>Simon</u>

Table 6.7 shows the summary of Simon's pattern of getting information from the Walk.

Table 6.7: Simon's pattern of navigation within the Walk

Time	Different Levels of Navigation			
	Level-1	Level-2	Level-3	Level-4
0.56.32	map (F47), reads description	walks around		
0.59.11		walks around		
0.59.29	map	walks around (3 times)		
1.00.59	map (F21)	looks around (2 times)		
		walks around (8 times)		
1.06.24	map (F41), reads description			
1.07.48	map, moves to nr railway, reads description	looks around (2 times)		
		walks around		
		looks around (7 times)		
1.11.58	map, moves to nr railway, F10, reads description	looks around		
		walks around		
		looks around (6 times)		
1.15.15	map, moves	looks around (10 times)		
1.16.41	map (F26/27), move to F22	looks around (8 times)		
1.20.13	map, move to F5	looks around (8 times), reads description		
1.21.24	map, move to F33 north			
1.22.35	map	looks around (10 times), reads description		
1.23.44			plants	
1.24.38			animals	
1.24.24			animals	
1.25.08			animals	
1.25.29				photo + text
1.26.36			plants	
1.26.57			plants	
1.27.15				photo + text

Simon's navigation within the Walk shows three distinctive phases. Phase one is when he started with level-2 type of navigation (0.56.32). He used arrows to move his location. After doing this several times, the second phase started when he did a combination of level-1 and level-2 types of navigation (1.07.48). He used the map to move to a new location and used arrows to do a thorough search of the areas visited. The third phase was when he looked at the photographs of plants and animals at the last location selected, hence it was a level-4 type of navigation (1.23.44). Simon visited 8 out of the 47 fields. Following is the summary:

Level-1	0 times
Level-2	9 times
Level-1 & Level-2	6 times
Level-3	0 times
Level-4	1 times
Number of fields visited	8 fields

The above analysis shows Simon as doing more of the level-2 type of investigation, i.e., looking at the fields more closely. He did not look at wildlife at each location he visited. Simon's approach to getting information could be classified as 'deep'.

William

Table 6.8 shows the summary of William's pattern of getting information from the Walk.

Table 6.8: William's pattern of navigation within the Walk

Time	Different Levels of Navigation			
	Level-1	Level-2	Level-3	Level-4
0.18.20		walks around (8 times)		
0.20.40	map (F38)	walks around		
0.21.50		looks around (6 times)		
0.23.00		walks around		
0.23.21		looks around (4 times)		
0.23.42		walks around (2 times)		
0.24.06		looks around (4 times)		
0.24.36		walks around		
0.24.53	map (F34)	walks around (10 times)		
0.27.11		looks around (5 times)		
0.29.03	map (F20), moves to F12, reads description	looks around (3 times)		
0.31.10		walks around (5 times)		
0.32.12	map (F20)	looks around (3 times)		
0.33.23	"	walks around (7 times)		
0.34.20		looks around		
0.34.42		walks around (8 times)		
0.36.02	map (F16)	Looks around (9 times)		
0.37.28		walks around (3 times)		
0.37.54	map (F6)	looks around (7 times)		
0.39.51		walks around (5 times)		
0.41.07	map (F30)	walks around (9 times)		
0.43.00	map (F41)	looks around (5 times)		
0.43.36		walks around (3 times)		
0.44.23		looks around (5 times)		
0.44.48	map (F40)	walks around (2 times)		
0.45.30	map (F42)	walks around (12 times)		
0.48.04	map (F33)	walks around (15 times)		
0.01.59			plants	
2.00.03				photo + text
2.00.35			plants	
2.00.46			animals	

William started to walk on the farm by employing the level-2 type navigation. He used the arrows to walk around and clicked on the left and the right of the screen to look around. According to the table, he always used this method to navigate within the Walk. On one occasion he did the combined level-1 and level-2 type. Towards the end of the session he looked at a few examples of wildlife. Following is the summary:

Level-1	0 times
Level-2	26 times
Level-1 & Level-2	1 times
Level-3	3 times
Level-4	1 times
Number of fields visited	11 fields

The above analysis shows that William was interested in looking at fields more closely, hence doing more of the level-2 type of navigation. William's approach to getting information could be classified as 'deep'.

Analysis

The above data can be summarised for a comparative analysis of each user's pattern of information gathering from the Walk. Table 6.9 presents such a summary. In the table, features such as the time spent on the Walk, the number of fields visited and the pattern of investigation are recorded against each user.

Table 6.9: A summary of the navigation within the Walk

Indicators of learning	Martyn	Tim	Steven	Robert	Neil	Duncan	Simon	William
Time spent (minutes)	84	36	44	60	47	41	35	37
No. of fields visited	20	17	16	37	9	13	8	11
Level-1: the brisk walk	4	15	4	44	5	5	0	0
Level-2: the detailed walk	20	3	12	31	0	9	9	26
Combined Level-1 and Level-2	21	3	4	3	9	2	6	1
Level-3: looking at lists of wild life	8	4	1	1	1	0	0	3
Level-4: looking at details of wildlife	0	4	3	4	6	6	1	1

In order to compare how each user sought information from the Walk, the information in each column of Table 6.9 can be separately analysed. Figs. 6.1-6.7 present this analysis. Fig. 6.1 is a comparison of the time spent by each user in the Walk; Fig. 6.2, a comparison of the number of fields visited by each user; Fig. 6.3, a comparison of the number of level-1 walks done; Fig. 6.4, a comparison of the number of level-2 walks done; Fig. 6.5, a comparison of the number of combined level-1 and level-2 walks done; Fig. 6.6, a comparison of the number of level-3 walks done; and Fig. 6.7, a comparison of the number of level-4 walks done by each user.

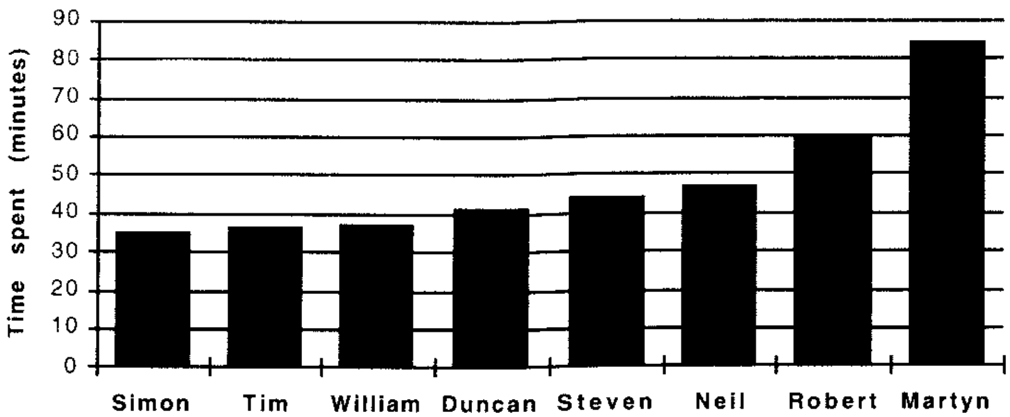

Fig. 6.1: Time spent by each user

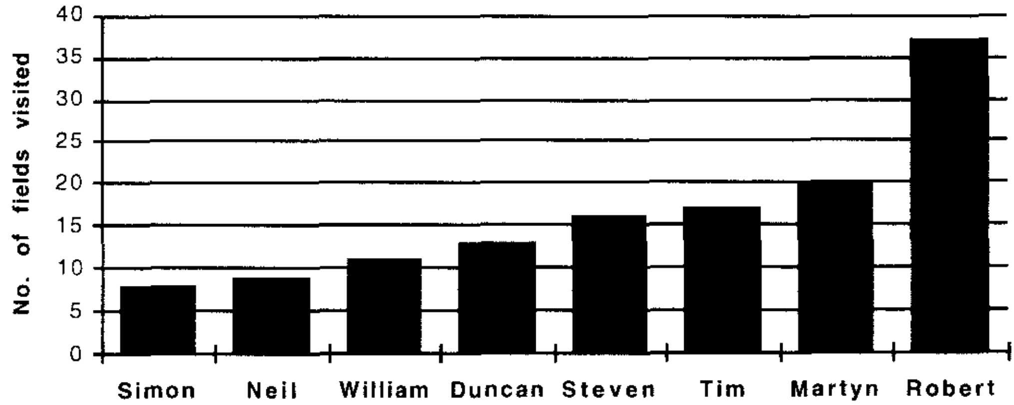

Fig. 6.2: No. of fields visited by each user

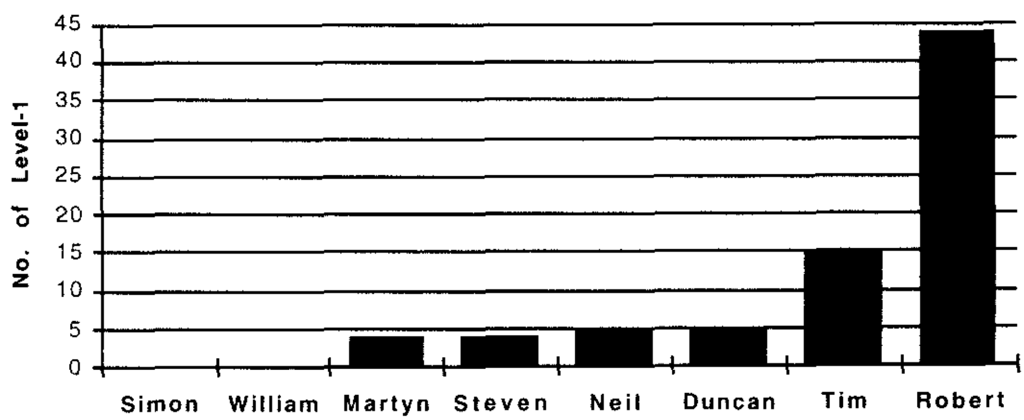

Fig. 6.3: No. of level 1 walks by each user

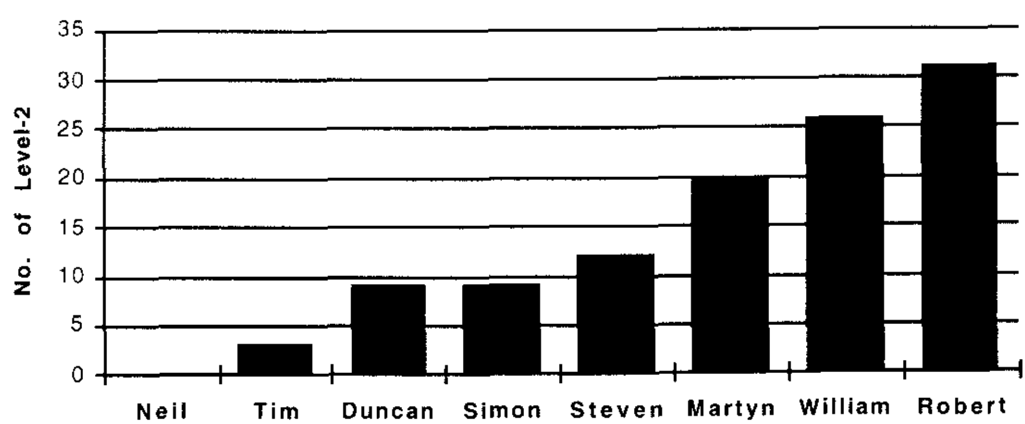

Fig. 6.4: No. of level 2 walks by each user

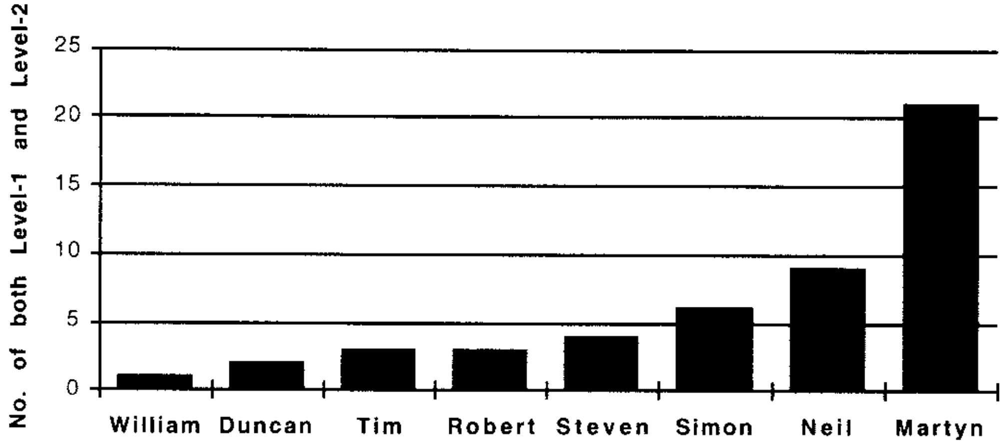

Fig. 6.5: No. of level 1 with level 2 walks by each user

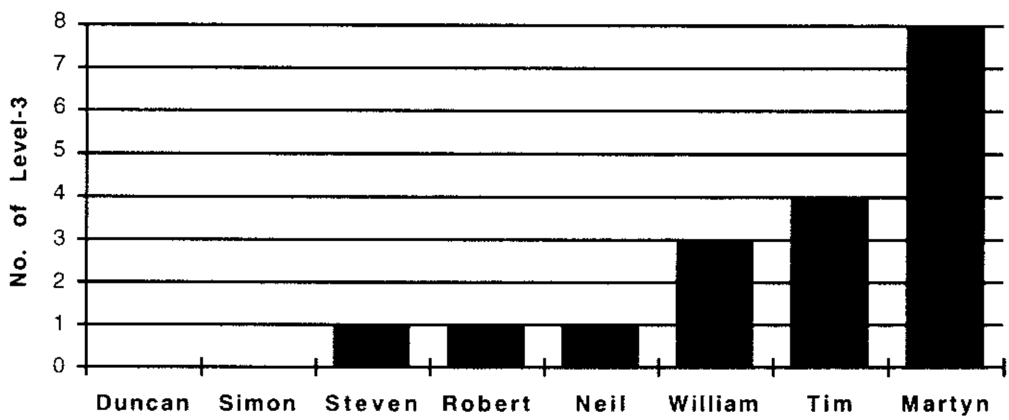

Fig. 6.6: No. of level 3 walks by each user

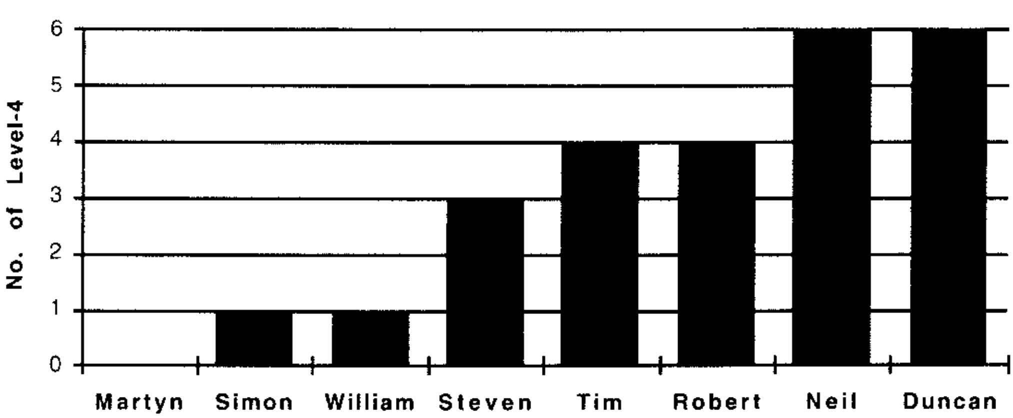

Fig. 6.7: No. of level 4 walks by each user

Fig. 6.1 shows that Martyn spent the longest time in the Walk section, followed by Robert. Simon spent the shortest time. Tim spent more time than Simon did.

Although Martyn spent the longest time in the Walk, hence occupying the highest rank order in Fig. 6.1, he ranks second in Fig. 6.2 in terms of the number of fields visited. Robert has moved to the highest rank in Fig. 6.2. This may be because Robert employed more of level-1 type navigation than Martyn did, as the Fig. 6.3 shows. The rank order of Simon, William, Duncan and Steven remain the same in both Fig. 6.1 and Fig. 6.2.

Tim who spent less time in the Walk (Fig. 6.1) has investigated the third largest number of fields (Fig. 6.2). This may be because he used more of level-1 type navigation (brisk walks) only second to Robert, as Fig. 6.3 shows. Neil's case is the complete opposite of Tim's. Neil spent the third longest time in the Walk (Fig. 6.1), but managed to visit only a fewer fields (Fig. 6.2). This is because Neil spent more time looking at details of wildlife, as Fig. 6.7 shows.

Figs. 6.3 and 6.4 show that Robert has done the largest number of level-1 and level-2 types of navigation. This means that he did the largest number of 'brisk walks' covering more fields while still looking closely at many fields. This might have allowed him to have both a better overall idea of the farm and a better insight into each field. However, as Figs. 6.6 and 6.7 show he ranks in the middle as far as looking at details of wildlife. Perhaps he did not want to go into too much detail of the farm.

According to Fig. 6.3, Simon and William ranked lowest as far as the number of level-1 walks they did. They were not interested in just browsing. Rather, as Fig. 6.4 shows, they wanted to do more of the level-2 type navigation, that is, to study individual fields in detail. In Fig. 4, William ranks second highest and Simon ranks in the middle. Simon ranks even higher in Fig. 6.5.

Martyn and Steven, who rank in the middle as far as level-1 navigation is concerned (Fig. 6.3), move to higher ranks in Fig. 6.4 that shows users' level-2 navigation. This shows that both these users were more interested in getting a better understanding of individual fields they visited. Martyn ranked highest in Fig. 6.5, i.e., he was the user who carried out the largest number of combined level-1 and level-2 navigation.

Neil's spending of a long time in the Walk (Fig. 6.1) can be explained by the number of level-4 type observations he did, looking at photographs of wildlife (Fig. 6.7).

The next step is to compare the farmers' overall approach to learning from the Walk section. For this, data for the indicators identified as contributing to learning from the Walk (time spent, number of fields visited, etc.) were converted to ordinal data (data were rank-ordered). In order to use ordinal measurement, 'the ordinal transitivity postulate' needs to be justified (Kerlinger, 1964, p. 422), that is, data should be able to be ranked according to their position along a continuum. Data in the above figures satisfy this criterion. For instance, farmers can be ranked according to the time spent on the Walk. In this way, Simon ranks lowest and Martyn ranks highest. Therefore, Simon gets a rank value of 1 (the lowest) and Martyn gets 8 (the highest). Rank value is the numeral assigned to the rank order ((Kerlinger, 1964).

Several authors (Kerlinger, 1964; Calder, 1996) warn that ordinal numbers should not be interpreted in terms of their values. 'Ordinal numbers indicate rank order and nothing more. The numbers do not indicate absolute quantities, nor do they indicate that the intervals between the numbers are equal. For instance, it cannot be assumed that because the numerals are equally spaced the underlying properties they represent are equally spaced (Kerlinger, 1964, p. 424). Therefore, in this analysis, the rank ordering will not be used to do any 'measuring'. The sole purpose will be to represent how individual farmers ranked in relation to the others.

6.22 Within the Office

Pattern of getting information

The office section consists of four items from which the users could get information related to their learning task. These four items are:

- The 'VCR' showing a videoclip containing background information about the farm;
- The 'Computer' giving 4 kinds of farm accounts;
- The 'Television' showing opinions of 12 interest groups and related textual reads descriptions;
- The 'Files' giving access to mini case studies and related photographs and textual reads descriptions.

The users were free to get information from these four sections. However, the users varied in their use of these four sections. Some wanted to get information from all the sections, whereas others got information from only a few of the items. The two basic indicators discussed under 1.2, i.e., the time spent and number of sections covered, will be used to analyse each user's approach to getting information from the Office.

Martyn

Martyn used only two items in the Office to obtain more information: 'VCR' and the 'Computer'. He listened twice to the videoclip that gives background information about the farm. He also obtained information from two kinds of farm accounts, spending altogether 16 minutes in the Office. Table 6.10 summarises how he obtained information from the Office:

Table 6.10: A summary of getting information from the Office by Martyn

0.22.08	computer	
0.22.39	VCR	
0.28.41	television	
0.29.32	files	
0.30.20	computer	
0.30.27		one account

0.51.59	computer	
0.52.17		balance sheet

2.34.02	VCR	

Tim

Tim used all the four items – the 'VCR', the 'Television', the 'Computer' and the 'Files' to get information. However, he used only one component within each item. For instance, he looked at only one kind of farm accounts within the 'Computer'. Tim spent 14 minutes in the Office. Table 6.11 the summary of how he accessed information from the Office.

Table 6.11: A summary of getting information from the Office by Tim

0.52.01	VCR	
0.57.58	computer	
0.58.13		balance sheet
0.59.23	VCR	
1.00.29	television	
1.00.52		local
1.13.45	files	
1.14.06		one essay

Steven

Steven used more items in the Office to get information than Tim did. He listened to 5 interest groups and looked at all the four types of farm accounts within the 'Computer'. However, he did not look at the files. Steven took 36 minutes to get information from the Office. Table 6.12 shows summary of how he accessed information from the Office.

Table 6.12: A summary of getting information from the Office by Steven

0.08.18	television	
0.08.42		District Council
0.11.22		MAFF
0.13.01		NFU
0.15.12		Rural Development Commission
0.16.51		Countryside Commission
0.18.31	VCR	
1.11.48	computer	
1.12.10		first account
1.15.54		fixed costs
1.19.53		estate finances
1.21.38		balance sheet

Robert

Robert's pattern of getting information from the Office was more detailed than Tim's and Steven's. He listened to the VCR as the other two did. Also he looked at all the farm accounts as Steven did. Robert listened to all the interest groups on the 'Television' where as Steven listened to only five. The main difference was that Robert read nine case studies within the 'Files'. Steven did not read any of the case studies whereas Tim read only one page of one file. The total time Robert took was 63 minutes. Table 6.13 shows how Robert accessed information from the Office.

Table 6.13: A summary of getting information from the Office by Robert

0.04.57	VCR	
0.10.45	computer	
0.11.36		gross margins
0.14.56		fixed costs
0.19.04		estate finances
0.20.50		balance sheet
0.24.41	files	
0.25.06		Birdwood Field SSSI
0.27.53		Boating
0.28.57		Develop a caravan site
0.29.30		Floods
0.32.43		Nitrates
0.33.42		Oil and gas exploration
0.36.04		Redundant fm buildings
0.38.54		Rural housing schemes
0.42.03		Selling farm produce
1.46.16	television	
1.46.27		Nature Conservancy Council
1.48.19		Countryside Commission
1.49.59		Rural Development Commission
1.51.28		District Council
1.53.16		MAFF
1.54.28		NFU
1.56.11		Enterprise Consultant
1.57.38		Rambler
1.59.07		Wildlife Advisor
2.00.28		Parish Council
2.01.43		Labour Union
2.02.58		local

Neil

There were differences in Neil's pattern of information access compared with those of the other four users discussed so far. He read five case studies but went on to access photographs and textual reads descriptions related to the case studies as well. In that way this is a more detailed approach to getting information. He listened to five interest groups Here too he went on to read textual reads descriptions attached to the videoclips. That too was a more detailed approach, but he listened to fewer interest groups and read fewer case studies than Robert did. A main difference was that Neil did not look at the financial information from the 'Computer'. Neil spent 35 minutes in the Office. Table 6.14 shows how Neil accessed information from the Office.

Table 6.14: A summary of getting information from the Office by Neil

0.55.51	files		
0.56.26		Birdwood field SSSI	
1.01.24		Boating	
1.03.29		New workshop developments	
1.05.38		Birdwood field	
1.06.38		Boating	
1.06.54			photo
1.07.34			photo + text
1.08.20			photo
1.08.36			photo
1.08.55			photo
1.12.12	VCR		
1.23.54	television		
1.25.33		District Council	
1.30.47		Local	
1.32.02			action

1.33.00		Parish Council	
1.34.02			action
1.35.32		Rural Development Commission	
1.37.18		Nature Conservancy Commission	

Duncan

Duncan read all four farm accounts and listened to all 12 interest groups. Also he went on to read one textual information attached to a videoclip. In that way his information access was more detailed than that of Robert. However, Duncan read only a couple of case studies, less than Neil and Robert. He also went on to look at photographs and textual reads descriptions attached to the case studies, an approach similar to that of Neil. Duncan spent 48 minutes in the Office. Table 6.15 shows how Duncan accessed information.

Table 6.15: A summary of getting information from the Office by Duncan

0.10.30	computer		
0.10.46		balance sheet	
0.12.06		gross margins	
0.13.16		fixed costs	
0.18.58	television		
0.19.17		Nature Conservancy Council	
0.20.49			summary
0.23.36		Countryside Commission	
0.25.30		Rural Development Commission	
0.27.03		District Council	
0.28.38		MAFF	
0.29.54		NFU	
0.31.38		Enterprise Consultant	
0.33.04		Rambler	
0.34.34		Wildlife Advisor	
0.36.45		Parish Council	
0.38.03		Trade Union	
0.39.19		Local	
0.40.58	VCR		
0.47.06	files		
0.47.43		Pesticides and wildlife	
0.49.46			photo + text
0.50.23			photo
0.50.38			photo
0.51.12			photo + text
0.53.05		Redundant farm buildings	

Simon

Simon's approach to getting information from the Office was quite different compared with the other users. He accessed fewer components from individual items but went on to read more information from the case studies. The total time spent was 45 minutes. Table 6.16 shows how Simon accessed information from the Office.

Table 6.16: A summary of getting information from the Office by Simon

0.12.23	computer		
0.12.42		balance sheet	
0.14.22		gross margins	
0.19.04		fixed costs	
0.20.03	VCR		
0.31.05	television		
0.32.08		Nature Conservancy Council	
0.34.46		Enterprise Consultant	
0.36.21		NFU	

0.38.10		Local	
0.40.37	files		
0.41.22		Developing a caravan site	
0.46.05		Redundant farm buildings	
0.46.56			photo + text
0.49.48		Nitrates	
0.51.01			photo
0.51.27			photo

William

William obtained information from all the four items. He read four farm accounts, looking at one account twice. He listened to the videoclip that gives background information about the farm. He only listened to a spokesperson of one interest group though he read all the textual information attached to that videoclip. Finally he read one mini case study. Table 6.17 shows how William accessed information:

Table 6.17: A summary of getting information from the Office by William

0.55.58	computer		
0.56.28		gross margins	
1.01.40		fixed costs	
1.02.47		estate finances	
1.03.27		balance sheet	
1.04.26		fixed cost	
1.05.48	VCR		
1.13.46	television		
1.14.04		Ramblers	
1.15.54			policy
1.18.02			action
1.20.08		Wildlife Advisor	
1.21.40		Nature Conservancy Council	
1.23.28		District Council	
1.26.58	files		
1.27.20		Hedgerows	
1.28.15			photo + text
1.28.43			index
1.28.55			photo + text
1.29.31			index
1.29.40			photo
1.29.47			index
1.29.52			photo
1.30.00			index
1.30.07			photo
1.30.58			index
1.30.57			photo + text
1.31.27			index
1.31.33			photo + text
1.31.55			index
1.32.19		essay	

Analysis

The information regarding the approach adopted by each user to access information from the Office is summarised in Table 6.18.

In Table 6.18 a scoring system was used to identify the number of pieces of information each individual read or viewed. One score was given for either watching a videoclip or reading a textual page of information. A dot in the table represents one score. The line second from the bottom shows the total score for each user.

Table 6.18: A summary of how individual users obtained information from the Office

Item	Component	Martin	Tim	Steven	Robert	Neil	Duncan	Simon	William
VCR		••	•	•	•	•	•	•	• ••
Computer	Gross margins	•		•	•		•	•	•
	Fixed costs	•		•	•		•	•	•
	Estate finances			•	•		•		•
	Balance sheet		•	•	•		•	•	
Television	Nature Conservancy Council				•	•	•	•	•
	Countryside Commission			•	•		•		
	Rural Development Commission			•	•	•	•		
	District Council			•	•	•	•		
	MAFF			•	•		•		
	National Farmers' Union			•	•		•	•	
	Enterprise Council				•		•	•	
	Rambler				•		•		•
	Wildlife Advisor				•		•		•
	Parish Council				•	•	•		
	Trade Union				•		•		
	Local		•		•	•	•	•	
Files	Birdwood Field: SSSI		•		•	•			
	Boating				•	•			
	Develop a caravan site				•			•	
	Floods				•				
	Nitrates				•			•	
	Oil and gas exploration				•				
	Redundant farm buildings				•		•	•	
	Rural housing schemes				•				
	Selling farm produce				•				
	New workshop development					•			
	Pesticides and wildlife						•		
	Hedgerows								•
The score		4	4	10	26	9	19	11	10
Time (min)		16	14	36	63	35	48	45	42

Each individual's use of the Office section could be comparatively analysed in order to find out their intensity of information gathering. Figs. 6.8 and 6.9 show such a comparison. Fig. 6.8 shows the comparative time spent by each user in the Office getting information. Fig. 6.9 represents the number of sections covered by each user. This was derived from the score each user was given for the total number of videoclips they listened to and textual pages they read.

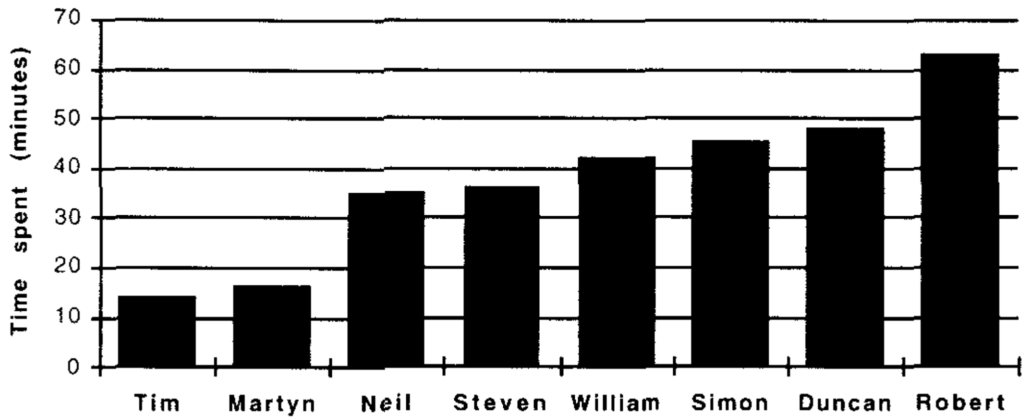

Fig. 6.8: Time spent by each user in the Office

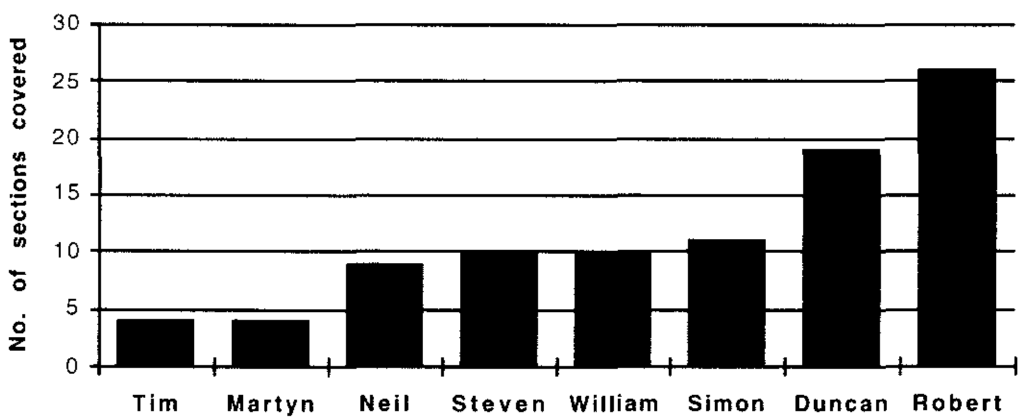

Fig. 6.9: No. of sections covered by each user

According to Fig. 6.8, Robert was the user who spent the longest time in the Office. Duncan. Simon and William followed him. Tim spent the shortest time. Martyn spent more time than Tim but less time than the rest of the users.

Fig. 6.9 shows the number of sections each user covered within the Office. According to the figure, Robert used the largest number of sections to get information. He is followed by Duncan, Simon, and William. Tim and Martyn used the least number of sections.

Both the figures follow a similar pattern. The rank order of the farmers is maintained. Those who spent more time in the Office were able to cover more sections than those who spent less time.

Farmers' overall approach to learning from the Office section was compared by using the same analytical method adopted in the Walk section. Farmers were rank ordered in terms of the two indicators identified as contributing to learning from the Office (time spent and number of sections covered). These rankings were then combined to give a combined ranking which indicated the comparative effort of each farmer in the Office. Fig. 6.10 shows the combined rank for each farmer.

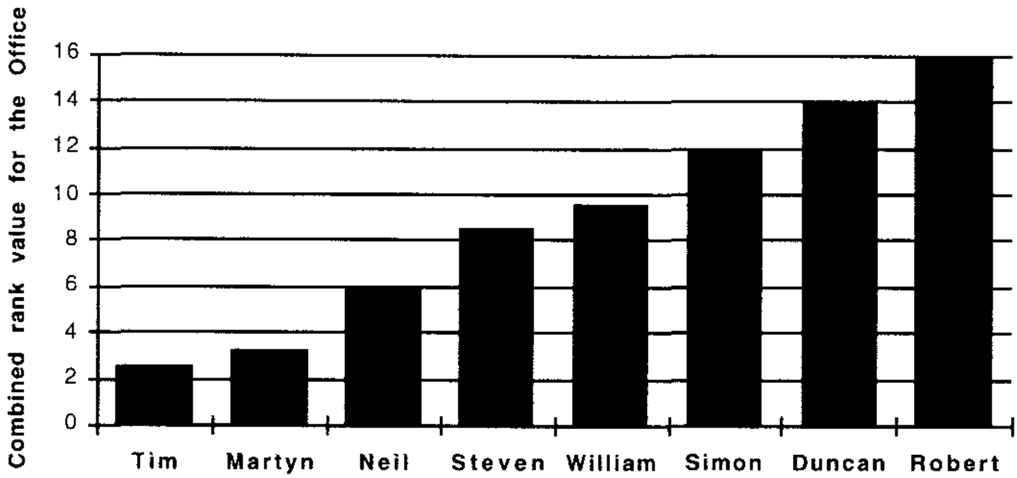

Fig. 6.10: Farmers' rank order according to the effort made to learn from the Office

According to Fig. 6.10, Robert made the highest effort to learn from the Office, followed by Duncan. Tim made the least effort.

6.23 Within the Plan

The Plan is the section that provides the users with the opportunity to make their own farm management decisions for the management of the farm. For this the users are expected to have done an adequate investigation within the Walk and the Office. The Plan section provide detailed information on individual farm management actions. These include detailed lists of all the crops, livestock and non-farming operations that are possible for each field and short pieces of information for each operation. Thus, once in the Plan, the users would carry on studying more about the farm before making their own management decisions.

The Plan is arranged as different levels, but the level structure in the Plan is different from the 'levels' used to describe indicators of learning from the Walk. The highest level in the Plan is the first screen where all the possible actions and enterprises are categorised into a list of 19. All the actions concerned with pure farming operations, conservation-related activities and local economic considerations fall within this list. This list is 'Level 1' of the Plan. By selecting each, the user could go to the next level down and so on. Each level gives a further break down of the actions chosen. For instance, by selecting 'farm workers' the user would go to the Level 2 for that particular action that gives a list of following four, which is a breakdown of farm labour:

1 Arable workers
2 Stock workers
3 Farmer's own effort
4 Students

If the user wants to change the arable workers, he or she would select 'Arable workers'; the program would take the user to 'Level 3' for that particular action. This gives a list of numbers of arable workers that it will be possible to employ on the farm. The user then could select the number of arable workers wanted. Once an action is selected, it is highlighted. The program may not allow some actions if they violate the general assumptions built into the program. In such situations, the user could do any of the following three:

- change the decision and make a different selection
- go back to the list of actions and fulfil the program's requirement. For instance if the reason is not having enough labour, go back to increase the labour first
- refrain from making the change.

The five indicators of learning described in section 1.3 (the time spent, the number of categories studied, number of pieces of information sought, the number of actions selected and the number of plans submitted) will be used to analyse each user's approach to getting information from the Plan.

Pattern of getting information

Martyn

Table 6.19 summarises Martyn's pattern of navigation within the Plan.

Table 6.19: A summary of Martyn's pattern of navigation within the Plan

0.35.56	plan		
	Landuse		
0.39.24	List		
		Info: Potatoes	
		F2, options	
	Landuse	Info: soil grade 2 fields	
	Landuse		
	List		
0.47.30	List		
0.54 25	Land use	soil grade 2 fields	F2, list of options
0.54.55			Info: winter wheat
0.55.46			winter wheat at int. 1
0.55.56			Info: winter wheat
0.57.30		soil grade 3/4 fields	Info: F1
0.59.28		soil grade 2 fields	Info: F2
1.00.26			Info: F3
			Info: F4
			Info: F6
			Info: F7
			Info: F8
			Info: F9
			Info: F10
			Info: F11
			Info: F12
			Info: F13
			Info: F14
			Info: F15
			Info: F16
			Info: F17
			Info: F18
			Info: F19
			Info: F30
1.14.36		soil grade 5 fields	Info: F27
			Info: F36
			Info: F37

			Info: F40
			Info: F41
			Info: F42
			Info: F44
			Info: F45
			Info: F46
			Info: F47
1.24.45			Info: grazing
1.26.35		grade 5 fields list	Info: F47

2.34.40	Livestock operations	Info: Dairy cattle	
		Heifers less than 1 year old	
		Info: Heifers less than 1 year old	
		Info: Beef cattle above 1 year old	
		Info: Sheep	
2.38.39	Quotas	Info: Milk quotas	
2.40.27	Build extra milking parlour	Info: Building milking parlour	
	Build barns for livestock	Info: Barns for livestock	
2.42.23	New farm enterprises	barn enterprises	Info: Convert to tourist centre
			Info: Tourist centre
2.45.37	Build grain storage	Info: Build grain storage	
2.47.01	Disused railway station	Info: creating a community centre	
		Info: Convert to workshops	
		Info: Build workshops	

Martyn spent 65 minutes in the Plan. He looked at eight categories and obtained more information on 47 items. Table 19 shows that he obtained information on most of the fields. However he selected only one action and did not submit any plans.

Tim

Table 6.20 summarises Tim's pattern of navigation within the Plan.

Table 6.20: A summary Tim's pattern of navigation within the Plan

0.20.29			
0.21.29	Landuse	Grade 2 fields	Info: F2
0.22.58	Livestock operations		
0.23.30	list		

1.03.03	New fm enterprises	Barn enterprise	**tourist centre**	
1.05.42	**Submit**			
1.09.12	Land use	Grade 2 fields	F2, options	**winter wheat at int. 1**
1.09.49				Info: winter wheat
1.10.51			F?	Info: F11
1.12.15				Info: F?

Tim spent 15 minutes in the Plan section. He looked at two categories, land use and new farm enterprises briefly. He then looked at four pieces of information and made a couple of selections. He did not listen to the feedback for his actions.

Steven

Table 6.21 summarises Steven's pattern of navigation within the Plan.

Table 6.21: A summary of Steven's pattern of navigation within the Plan

1.25.13	List		
1.27.16	Landuse	Grade 2 fields	
1.27.28		Grade 3/4 fields	
1.30.02		Grade 5 fields	Info: F?
1.34.02	Livestock	Info: heifers < 1 years, options	
1.34.23		Heifers < 1 years old, options	
1.35.06		Sheep, options	Info: sheep
1.37.17	Farm workers	Arable workers, options	Info: arable workers

1.38.34	Farm workers	Stock workers, options	
1.38.40		Farmers own effort, options	
1.39.07		Students, options	
1.39.56	Machinery requirements	Tractor requirements	
1.40.04		Combine requirements	
1.41.04	Quotas	Milk quota	Lease in milk quota
1.41.51	Houses	Info: House 6	
1.41.59		Info: House 1	
1.43.31	List		
1.44.54		House 1, options	
1.45.52		House 2, options	
1.46.11		House 3, options	
1.46.32		House 4, options	
1.46.51		House 5, options	
1.47.08		House 6, options	
1.48.13		House 7, options	
1.48.38		House 8, options	
1.49.00		House 9, options	Info: rent house 9 to a local
1.50.44		House 8, options	Info: H 8 tied to a farmworker
1.51.25		House 4, options	Info: H 4 tied to a farmworker
1.52.39		House 9, options	Info: house 9 rent to a local
1.53.34	River & riverside	**Boat mooring**	Info: allow boat mooring
1.54.45		**Fishing**	Info: allow fishing
1.55.44	New farm enterprises	Convert farm buildings, options	**Conversion to farm shop**
1.56.20		Info: Farm shops	**No change to farm shop**
1.57.24		Info: convert for food production	**No change to farm buildings**
1.58.12	List		
2.00.18	Landuse	Info: grade 2 fields	Info: F2
2.01.46		F3, options	Info: F3
2.02.46		F4, options	Info: F4
2.03.38		Info: F6	
2.04.14		Info: F7	
2.05.00		Info: F8	
2.05.34		Info: F9	
2.06.03		F10, options	Info: F10
2.07.06		Info: F11	
2.07.38		Info: F12	
2.08.08		F13, options	Info: F13
2.09.08		F14, options	Info: F14
2.09.36			Info: F14
2.10.27		Info: F18	
2.12.01		F15, options	
2.12.29		Info: F16	
2.12.58		Info: F17	
2.13.37		Info: F18	
2.14.01		Info: F19	
2.14.42		Info: F30	
2.15.30	**Submit**		
2.17.11		Television	
2.18.11		Files	
2.18.49	**PLAN**		
2.19.09	Farm workers	Stock workers, options	**2 stock workers**
2.19.19			4 stock workers
2.19.30			3 stock workers

Steven spent 54 minutes in the Plan section looking at 8 major categories of actions. Some categories he observed more than once. Table 6.21 shows that he went through successive levels of each category of actions. Steven sought information for 34 actions and took notes. Also he made a few selections and submitted a plan.

Robert

Table 6.22 summarises Robert's pattern of navigation within the Plan.

Table 6.22: A summary of Robert's pattern of navigation within the Plan

1.44.29	Landuse	Grade 2 fields	F2, options	
2.13.16	Landuse	Soil grade 2 fields	F2, options	Info: 11 potatoes
2.16.14	List			

2.17.59				**F2: w wheat int. 1**
2.19.00				Info: F2
2.19.57				Info: 2nd in the list
2.20.29				**F2: w wheat int. 2**
2.21.05	List			
2.22.07	Land use	Grade 3/4 fields		
2.23.03	Farm workers			
2.23.17	Mach requirements	Tractor requirements		
2.23.50	Quotas	Milk quota, options		
2.24.15		Potato quota, options		
2.24.42	Build barns for livestock			
2.24.59	Build extra milking parlour			
2.25.14	Build grain storage	No grain storage		
2.26.21	List			
2.30.34	Land use	Grade 2 fields	F2, options	
2.32.39		Grade 2 fields	F2, options	Info: 11th F2 potatoes
2.33.04			F2, options	F2 potatoes
2.33.21				Info: 2nd potatoes int. 1
2.33.35				**f2: main potatoes at int. 1: bleep**
2.34.05				**3rd, F2 2nd potatoes int. 1: bleep**
2.34.21				**f2: main potatoes int. 1: bleep**
2.35.15	Farm workers	Students, options	**2 student workers**	
2.36.28	Landuse	Grade 2 fields	F2, options	**f2 main potato at int. 1: bleep**
2.37.02				**2nd potatoes at int. 1: bleep**
2.37.57				Info: F2
2.38.32	Quotas	Potato quota	**Lease in quota for 7 ha**	
2.39.05	Land use	Grade 2 fields	F2, options	**2nd potatoes at int. 1: bleep**
2.39.53	Quotas	Potato quotas	**Lease in quota for 8 ha**	
2.40.23	Land use	Grade 2 fields	F2, options	**2nd potatoes at int. 1**
2.40.54				**2nd potatoes at int. 2**
2.42.25	**Submit**			
2.43.46		Computer	Balance sheet	
2.44.50			Fixed costs	
2.46.03	Land use	Grade 2 fields	F2, options	**Oilseed rape at int. 2**
2.47.02	Quotas	Potato quotas	**No potato quotas**	
2.47.23	**Submit**			
2.48.35		Computer	Fixed costs	
2.49.26	Landuse	Grade 2 fields	F2, options	**Winter wheat at intensity 1**
2.50.08	Disused railway station	**Create a community centre**		
2.50.44	New farm enterprises	Convert farm buildings, options	**to small workshops**	
5.51.35		Farm house enterprises, options	**Farmhouse B&B**	
2.52.02	Managing Kingston brake			
2.52.25	Houses	House 9		
2.53.02	Land use	Grade 2 fields	F3, options	
2.53.46			F4, options	**Winter wheat at int. 2**
2.54.20			F6, options	**Winter wheat at int. 2**
2.54.51			F7, options	**Winter wheat at int. 2: bleep**
2.55.29				**Oil seed rape at int. 1: bleep**
2.55.52				**Oil seed rape at int. 1: bleep**
2.56.04				Info: Oilseed rape
2.56.52			F7, options	**Oilseed rape at int. 1: bleep**
2.57.33				**Oilseed rape at int. 2: bleep**
2.57.58				**Oilseed rape int. 2: bleep**
2.58.19				Grass for conserving
2.59.14				**Winter wheat at int. 1: bleep**
2.59.46		Grade 3/4 fields	F20, options	... grazing
3.00.18				**... for grazing int. 3: bleep**
3.00.51	List			

Robert was the user who spent the longest time, 78 minutes, to study the Plan section. He investigated 11 out of the 19 major categories, some of them more than once. He sought information for a number of actions. The most striking feature of Robert's approach was that he selected more actions than the others and submitted two sets of plans for which he received the feedback.

Neil

Table 6.23 summarises Neil's pattern of navigation within the Plan.

Table 6.23: A summary of Neil's pattern of navigation within the Plan

1.39.28	Ponds	Info: ponds	
1.40.13		Info: ponds	
1.40.26	Ponds	Pond 1	Info: fill in pond

1.41.26			**Enlarge ponds**
1.41.34			Info: clear south side of pond
1.42.05			**Dredge pond 1**
1.42.56	Managing scrubland	Scrub 1	Info: manage scrub 1
1.43.55			**Manage scrub 1: bleep**
1.44.07			Info: scrub 1
1.44.19			**Select clear scrub 1**
1.44.45	Landuse	Info: grade 2	
1.45.16		Soil grade 2 fields	Info: F2
1.46.49	List		
1.50.31	Disused railway station	**Convert to workshops,**	
1.50.51		**Create a community centre**	

Neil spent 14 minutes for the Plan, the shortest time compared with the others. He looked at 4 major categories and looked for information about 7 individual actions within those categories. He selected four actions for a plan but did not submit it.

Duncan

Table 6.24 summarises Duncan's pattern of navigation within the Plan.

Table 6.24: A summary of Duncan's pattern of navigation within the Plan

1.39.45	Landuse	Grade 2 fields	F2, options	**Winter wheat, int. 2**
1.42.32			F3, options	
1.43.18	List			
1.46.38	**Submit**			
1.47.53		Computer	Gross margins	
1.48.40			Fixed costs	
1.51.18			Balance sheet	
1.52.20		Television	MAFF	
1.54.10			Nature Conservancy Council	
1.55.55	Hedges and headlands	Hedges groups 1	Info: cut hedges yearly	
1.58.03			Info: lay hedges & meadow woodland	**Lay hedges: bleep**
1.59.08				**Lay hedges: bleep**
1.59.30			Info: lay hedges	**Cut hedges yearly**
2.00.58	**Farm workers**	Arable workers, options		
2.02.22	Hedges and headlands	Hedges group 1	**Cut hedges yearly**	
2.03.57	Farm workers	Info: arable workers		
2.07.32		Farmers own effort, options		
2.07.53		Students, options		
2.08.25	Land use	Grade 2 fields	F2, options	Info: F2
2.12.15			F2, options	
2.12.46		Grade 2 fields	F2, options	
2.13.37	Paths	Info: make nature trail	**Make nature trail**	
2.15.33	Livestock operations	Beef cattle < 1 yr. old, options	**No beef cattle < 1 year**	
2.16.18		Beef cattle > one year, options	**No beef cattle > 1 year**	
2.16.43		Sheep, options		
2.17.15	Hedges and headlands	Hedges groups 1, options	**Cut hedges yearly**	
2.18.00	List			
2.19.17	**Submit**			
2.20.32		Computer	Gross margins	
2.21.26		Television	Nature Conservancy Council	

Duncan spent 47 minutes in the Plan, less time than Robert but more time than Steven. He looked at 5 major categories and sought information for 6 individual actions. He selected 8 actions for the two plans he submitted and got the feedback.

Simon

Table 6.25 summarises Simon's pattern of navigation within the Plan.

Table 6.25: A summary of Simon's pattern of navigation within the Plan

1.31.28	Landuse	Grade 5 fields	Info: F47	
1.33.43			Info: F42	
1.34.34	Landuse			
1.35.22	Landuse	Grade 3/4 fields	Info: F20	
1.37.06			F1, options	Info: F1

1.40.35		Info: grade 2 fields		
1.41.33		Grade 3/4 fields	Info: F20	
1.42.37			Info: F21	
1.43.36			F29, options	
1.44.58	New farm enterprises			
1.45.20	New farm enterprises			
1.46.17	New farm enterprises	Convert farm buildings, options	**Conversion to holiday flats**	
1.50.11	**Submit**			
1.58.49	Livestock	Heifers > 1 year old, options		
2.00.32	Livestock	Sheep, options		
2.01.49		Heifers < 1 year old, options		
2.02.34	Disused railway station	**Create community centre: bleep**	Info: create a community centre	
2.04.04		**Build new workshops: bleep**		
2.05.22		**Build new workshops: bleep**		
2.05.34		**Create a community centre: bleep**		
2.06.05	Quotas	Potato quota, options	**Lease in quota for 9 ha.**	Info: lease in quota for 9 ha.

Simon spent 43 minutes, less time than Duncan. He investigated 5 major categories, sought information for 9 individual actions, and selected 3 actions for his plan.

William

Table 6.26 summarises William's pattern of navigation within the Plan.

Table 6.26: A summary of William's pattern of navigation within the Plan

0.08.06	Land use	Info: Soil grade 2 fields		
0.10.52		Soil grade 2 fields	Info: F2	
1.34.36		Soil grade 5 fields	Info: F37	
1.35.47			Info: F27	
1.36.03			F42, options	
1.36.37			Info: Grazing	
1.39.18			F45, options	
1.41.43		Soil grade 2 fields	Info: F2	**Large housing development**
1.43.40				Info: Housing development
1.46.06				**Grass for grazing int. 1**
1.48.49	Farm workers	stock workers, options	**1 stock worker: bleep**	
1.50.06		arable workers, options	**1 arable worker: bleep**	
1.50.26			**3 arable workers**	
1.50.39			**10 arable workers**	
1.50.47			**6 arable workers**	
1.51.08			**1 arable worker: bleep**	
1.53.36	List			
1.54.47	SUBMIT			
1.56.03	Computer	Fixed cost		
1.57.05	Television	Trade Union		
1.58.51	Walk	List of plants	photo + text	
2.00.35		List of plants		
2.00.46		List of animals		
2.02.30		F47, reads description		
2.04.58		looks around (2 times)		
2.05.13		walks around		

William spent 59 minutes in the Plan section although he only investigated 2 major categories. He sought information for 7 items, selected 3 actions and submitted one plan.

Analysis

Table 6.27 summarises how the individuals used the Plan section for the learning task.

Table 6.27: A summary of how the users approached the Plan

Indicators of learning (Plan)	Martin	Tim	Steven	Robert	Neil	Duncan	Simon	William
No. of categories investigated	8	2	8	11	4	5	5	2
No. of pieces of information sought	47	4	34	6	7	6	9	7
No. of actions selected	1	2	6	25	4	8	3	3
No. of plans submitted	0	0	1	2	0	2	0	1
Time spent (minutes)	65	15	54	78	14	47	43	59

This information can be displayed graphically in order to understand how each user approached the Plan section to get information. Figs. 11 to 15 show these graphs.

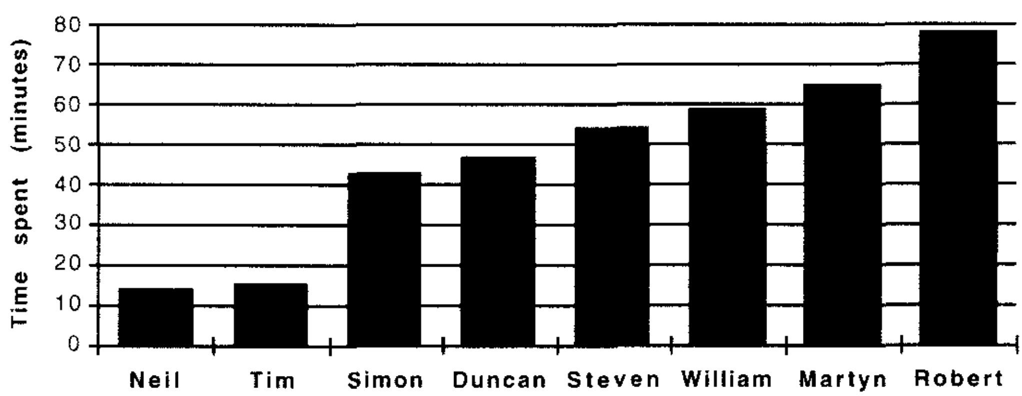

Fig. 6.11: Time spent by each user in the Plan section

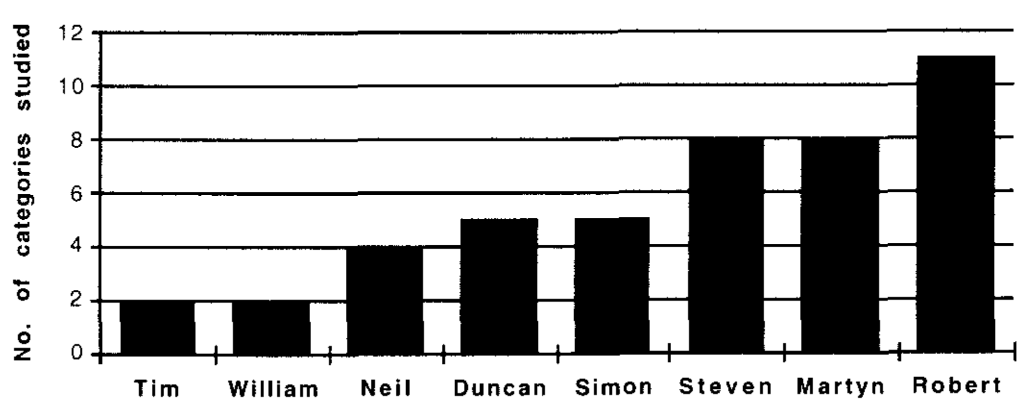

Fig. 6.12: No. of categories studied by each user

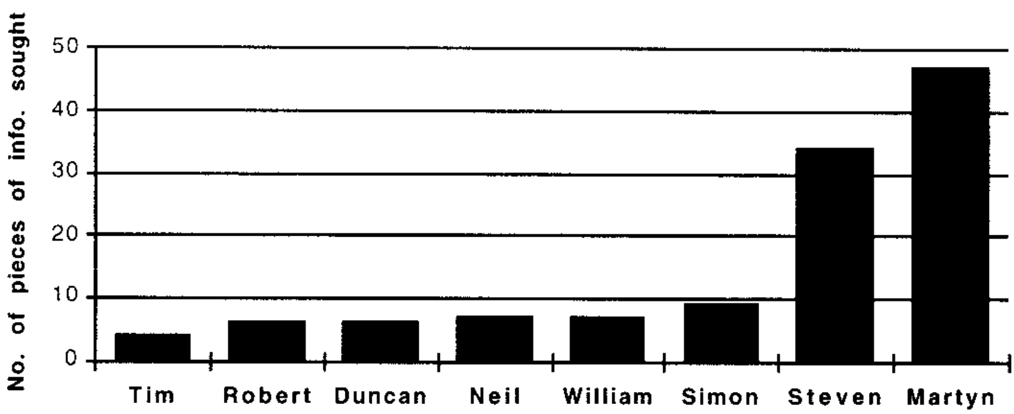

Fig. 6.13: No. of pieces of information sought by each user

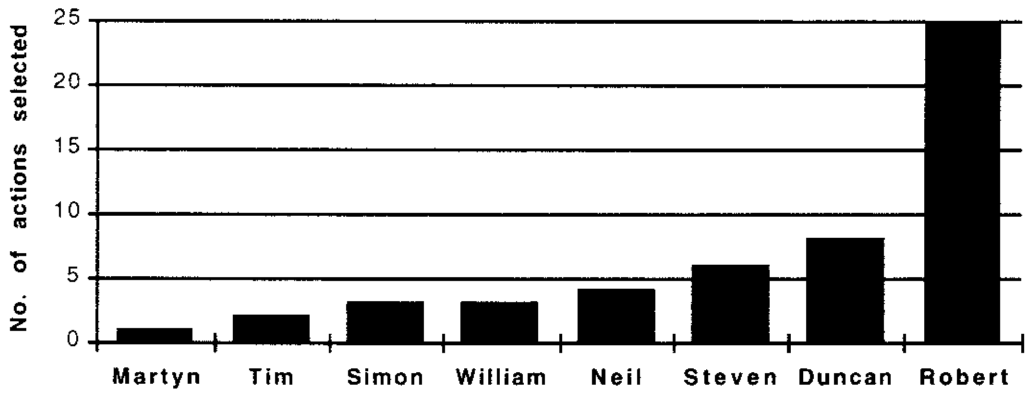

Fig. 6.14: No. of actions selected by each user

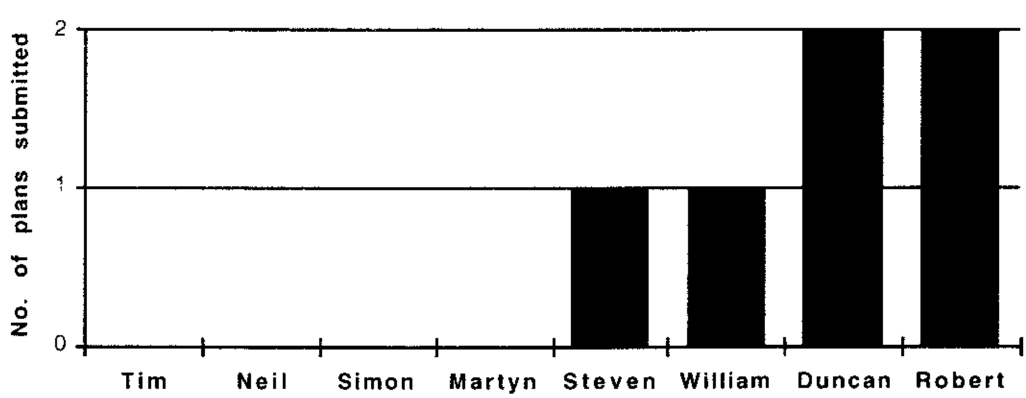

Fig. 6.15: No. of plans submitted by each user

Fig. 6.11 shows that Robert spent the longest time in the Plan, followed by Martyn, William and Steven. Neil and Tim spent almost equal times, but the shortest compared with the others.

Robert, who stayed in the Plan for the longest time, studied the largest number of categories (Fig. 6.12); selected largest number of actions (Fig. 6.14); and submitted largest number of plans (Fig. 6.15, Duncan too submitted same number of plans). Robert, however, sought less information (Fig. 6.13).

Martyn, who spent the second longest time in the Plan, kept his position in Fig. 6.12. He sought the largest number of pieces of information (Fig. 6.13). However, he ranks lowest as far as the number of actions selected (Fig. 6.14) and the number of plans submitted (Fig. 6.15). It appears that Martyn was more interested in looking for more information before making any decisions.

Tim who spent less time in the Plan, ranked low in the number of categories studied (Fig. 6.12), number of pieces of information sought (Fig. 6.13) and number of plans submitted (Fig. 6.15). Neil, who spent the least time in the Plan, ranked low in these activities, too.

Farmers' overall approach to learning from the Plan section was compared using the same analytical method adopted for the Walk and the Office. Farmers were given ranks for the five indicators identified as contributing to learning (time spent, number of categories studied, number of pieces of information sought, number of actions selected and number of plans submitted). These ranks were then combined to give a combined ranking; Fig. 6.16 ranks farmers according to the combined ranking.

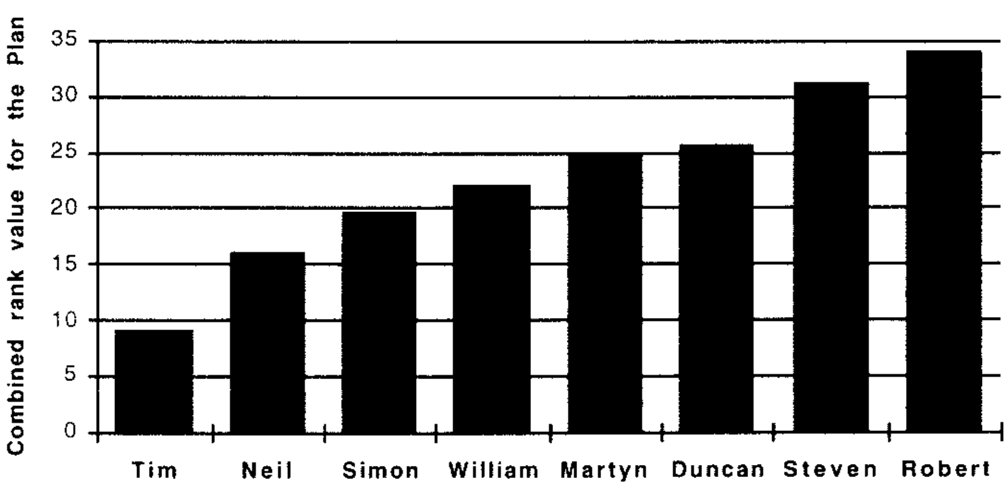

Fig. 6.16: Farmers' rank order according to the effort made to learn from the Plan

Robert ranks highest as far as the effort made to learn from the Plan section, followed by Steven and Duncan. Tim ranks lowest. Neil is the other farmer in the lower end.

6.24 Effort to learning from the program

This section so far analysed farmers' comparative effort to learning from the three sections of the program.

In order to arrive at an overall measure of how much effort each farmer put into learning from the whole program, the combined rankings for all three sections were added. The combined ranking for the Office needed to be weighted, however, because there were only two indicators of learning considered for the Office (time spent and number of sections covered); the Walk and the Plan had five indicators each (it is assumed that all three sections of the program are equally important for the learning task). Fig. 6.17 shows the overall combined ranking for each farmer.

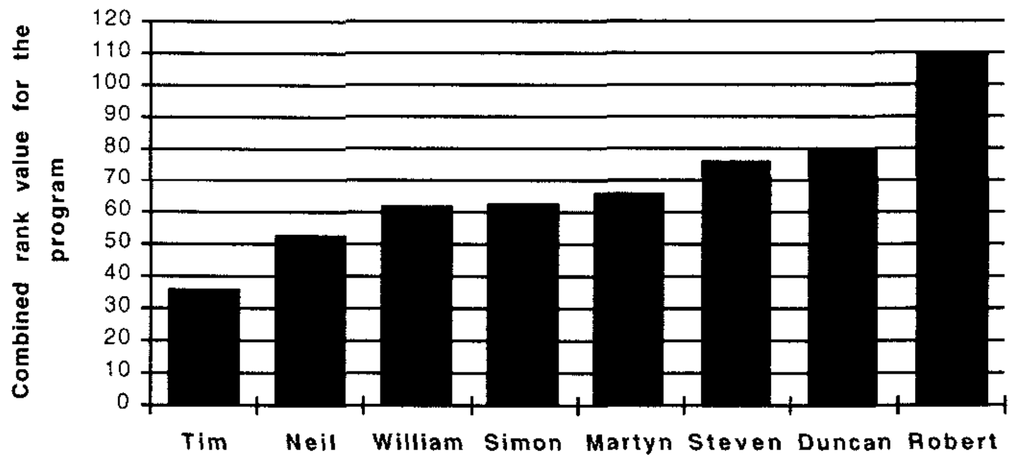

Fig. 6.17: Farmers' rank order according to the effort made to learn from the program

Fig. 6.17 positions farmers on a continuum, based on how much effort they put into learning from the program. At the top end are the farmers who put in much effort into learning from the program. Their learning approach is characterised by spending considerable time on the program, and studying it deeply and in detail. Towards the lower end are the farmers who put in less effort. Their learning approach is characterised by spending less time on the program and studying it at a surface level.

6.3 Conclusion

This analysis reveals that there is a difference in individual farmers' approach to learning from the program. Some farmers made much effort to learn from the program whereas others made less effort. The analysis ranked the farmers according to their effort. Chapter 7 analyses how these farmers made decisions in drawing up their plans, focusing specially on how the variation in their efforts to learn from the program influenced their decision-making process.

References

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Chapter 7
The main study: the farmers making decisions

This chapter analyses how the users arrived at their farm management decisions. As in the previous chapter the individual cases will be analysed separately. For each farmer the analysis will be focused on two aspects:

- how the farmers reacted when the program did not allow their decisions
- how the farmers' decision-making process was influenced by their particular approach to getting information

7.1 The analysis

Farmers drew up appropriate farm management plans by selecting particular actions, after getting information from the Walk, the Office and the Plan sections. They were expected to submit those plans and assess them based on feedback they received as well as their own opinions.

7.11 Reactions when the program rejects decisions

Martyn

Martyn faced the first rejection from the program when he tried to change the cropping on field 4. He wanted to 'conserve grass at intensity 1' but the program rejected his action. The reason given by the program was 'insufficient arable labour in July'. Martyn had been working on the program the previous night and was surprised to see this result:

> 'Insufficient arable labour in July' I didn't get that last night?. Why should 'insufficient arable labour' when I get into a forage area?

When the program rejects an action, the reason appears in the top message bar (a single line) that flashes. The program informed Martyn why it could not accept the action. However, Martyn was not able to understand how the reason related to his action. He spent some time thinking about the problem and decided to increase the labour.

On another occasion, when the program rejected another of his actions he was able to understand why it did so:

> Oh! I know what I haven't done, I haven't done my stockmen. I changed my stockmen yesterday. That makes a difference ... .

When he tried to grow winter wheat at intensity 1 on field 10, the program rejected his action. There was a small housing development proposed on that field. The reason for rejecting Martyn's new action was that the farm would face severe financial difficulties. The small housing development was to bring in funds to meet the deficit. Martyn understood the situation:

> (Laughter!) I need the money. If I don't sell it for development, I don't have enough money. Oh! it is crucial for everything else, selling that.

The last action that the program rejected was 'building new workshops' in the disused railway station. There were no activities proposed for this site. The reason given by the program was that his overdraft would exceed the limit. Martyn agreed:

> We can't do it anyway, I haven't got enough money.

He then read more information about building new workshops:

> Yes cost would be large.

Afterwards he wanted to know whether he could create a community centre instead. So he read more information about it, and realised that he could do that:

> Oh! We can afford to do it then.

Among the incidents cited above, there was one occasion when Martyn was not able to understand why the program rejected his action. This may be partly because the reason given by the program was very brief, just one sentence. This clue, however, led Martyn to re-think his action. On all the other occasions, he understood why the program rejected his actions. Sometimes he went on to read more information about possible other actions that he can take. This observation is comparable with Martyn's approach to learning from the program. Chapter 6 showed that Martyn put in a lot of effort to learn from the program (Fig. 6.17), spending considerable time, and was engaged in deep learning.

Tim

Tim faced his first problem when he decided to reduce the number of tractors. There were five tractors currently being used on the farm and he decided to reduce it to two.

The program did not allow that action. The reason given was that there would be insufficient machinery in October. Tim's reaction was that:

> The thing I don't really follow with this is if you, say for instance, if you try to run the farm with two tractors, for most of the year, but during the busy period, like when I just said I wanted two ... .

He tried once again but the result was the same:

> It says, 'insufficient machinery for October'. During the month of October you could have hired a contractor in to help you out in that busy period. But it doesn't give you that option, does it?

His intention was to keep only two tractors on a permanent basis. For the busy period of October he planned to hire a contractor. Since the busy period does not last long he thought that hiring a contractor would be the most economical way of running the farm. At this point he read further information about the machinery numbers suggested by the program and made his point:

> I assume that, when it (the information Tim just read) says that it means machinery for the 12 months of the year, whereas in October you could, you know, maybe you want three tractors or whatever for .... Just for that period, but the rest of the year you could manage with two.

When he failed to cut the tractors to two he attributed the situation to a problem with the program:

> Do you think, ... it's a bit of a fault in the programme that there is not enough options on it?
>
> There is no option here for hiring, is there?
>
> No flexibility in there, I don't think ... .

At this point he went on to see if the program would accept three tractors, but it did not. Tim chose to look at further information on tractor numbers in order to understand why the program did not allow him to reduce the tractor numbers:

> Yes, you see it says there, 'make sure you have enough machinery to cover the peak periods, but be careful machinery is expensive and you don't want to, want it standing around unused for long periods of time'
>
> So if we had the option of hiring a tractor for two or three months in the busy period in the autumn, say September, October and November, and then if they off hire you wouldn't have that tractor for the rest of the year standing idle doing nothing.

Later he tried to see if the program will allow four tractors, but it did not. In the end, he had to resort to five tractors, the original figure.

The farmer made the decision based on his knowledge and experience about the number of tractors necessary to run the farm. But the program did not agree with that decision. There appear to be a conflict between the underlying model of the program and that of the farmer. The program operates according to the assumptions and rules built into its model. The farmer also possesses his own assumptions and rules which govern his decision-making process.

The next problem he faced was when he wanted to change the way scrub area No. 1 was being managed. There are two scrub areas on the farm and nothing had been done to either of them. He wanted to manage the scrub area No. 1. The program did not allow it. Then he went on to scrub area No. 2 and read information about it. After reading the information he commented:

> There are certain things that, like scrub 1, you could manage it, do nothing or fence it. Scrub 2 in the explanation it says it's not fenced but it doesn't give you the option to fence it if you wanted to. So it limits your options quite a bit I think, I feel, but then, its almost as though its driving you down a certain path that's it wants you to take.

He found that there were only two options in scrub 2, whereas in scrub 1 there were three options. He thought that the program did not give him enough options and that it was trying to lead him to only a few actions. The clash here was that the farmer wanted more options, whereas the program provided only limited options, according to Tim.

Tim tried another move where he faced a problem. He chose to manage scrub area 2. The computer did not allow that action and the reason given was that there was insufficient machinery:

> There again it assumes, it's the farm labour, you could hire labour to manage the scrub for two or three weeks.

The incidents cited above, show that there were conflicts between the farmer and the program in terms of farm management decisions. The program rejected some of Tim's actions, and he was not able to understand why. In order to resolve these conflicts Tim should have made his contribution by trying to understand more about the farm and how the farm management decisions are interrelated. The conclusions drawn from Chapter 6 are not in favour of Tim. He put in the least effort to learn from the program, ranking lowest in terms of the overall combined ranking (Fig. 6.17).

Steven

Steven faced the first problem when he wanted to change the cropping on field 3. He wanted to grow winter wheat at intensity 1 instead of the current action of maize for conserving (silage). The program did not allow his actions and the reason given was that there would be 'insufficient conserved fodder'. He did not accept that reason:

> I don't want the cattle you see, don't want any conservation, because I am getting rid of all the cattle.

It appears that Steven was not able to understand the reasoning behind the feedback given by the program. A possible reason for this was that he was not able to understand the complexity of the model built into the program and how it works. The program takes all the information into account allowing an action. When Steven wanted to change the cropping, the program still held the information on existing cattle numbers and assumed that he was going to have cattle as well as to cutting down maize for conserving. I explained how the program behaved and he decided to sell the cattle first before changing the crop. From then onwards, he carried out the next series of actions without facing any objections from the program.

The next problem he faced was when he wanted to change the cropping on field 25. He wanted to grow 'spring wheat at intensity 1'. The current action for that field was 'conserving grass at intensity 1'. The program did not accept the new action, the reason being insufficient grain storage. Steven did not want to accept that:

> Well, that's crazy, It says on the farm, it has got 1000 tonnes of storage, then according to the computer they got no storage, but definitely there is a corn store there, I can see it on the pictures.

Steven thought there was a disparity of information.

Nevertheless, he went back to change the inputs according to the feedback given by the program. Later he increased the grain store by 100 tonnes and continued with his actions. He had no problems with the next series of changes until he came to field 33. He tried to grow winter wheat in this field. He knew that the program might not allow that action:

> Unfortunately I can't have any more grain storage, so I am going to have to ... this will probably say no. I can't have winter wheat, so reduce it somewhere else.

As expected the program did not allow that action. The reason was insufficient conserved fodder:

> storage basically. I got to go back... . I am going to get rid of 22, 23.

He accepted the feedback and went back to make other changes before doing his intended change. He put the fields 22, 23, and 24 to grazing and conservation and tried to do his original change in field 33, but the computer did not allow the action. This time the reason was insufficient conserved fodder:

> Haa! God! I have to get rid of more cattle, write all the cattle off obviously.
>
> Insufficient conservation there.

This series of events shows that Steven agreed with the program and changed his decisions accordingly.

The next steps were to get rid of heifers below 1 year and heifers over 1 year. Then he tried to do the action on field 33. The program accepted it:

> It likes that now (satisfaction). It likes that now

He continued with his plans. The next time he faced a problem was when he wanted to reduce the number of stock workers. The existing number was 2 stock workers. He cut it down to 1, but the program did not allow that and the reason given was that there would be insufficient labour in March for lambing:

> Huh! It is lambing in March (laughter), just tells me.

It appeared that here too he accepted the reasoning given by the program. He increased the student workers from 1 to 2 in response to the feedback. Then he tried to reduce the number of arable workers to 1. The program again did not allow that action for the same reason. Steven thought the number of workers he was suggesting would be quite enough:

> I have got 2 students, that is enough.

Now a conflict arose between the farmer and the program. Steven disagreed with the feedback. Nevertheless, he wanted to check the reasoning given for the feedback by the program, hence he read further information:

> I got to get information to see what it says.

Having read the information on stock workers he thought he was acting according to the program's suggestion:

> ... I have done that!. Can't do any more.

At this point the farmer was not able to understand exactly how the program operates; thus he gave up carrying on with that particular action. He did not want to increase the number of arable workers. Furthermore he reduced the number of student workers to the original figure.

The next time when he had a problem was when he tried to put in the number of tractors necessary for the farm. He was unable to calculate the number of tractors necessary for the cropping plan he was making:

> See I have no idea what the tractors are, It doesn't say what the tractors are.
> Let's have a look.

Currently the farm had 5 tractors. Apparently he wanted to reduce the number of tractors:

> I'll try for four and see what happens.

The program did allow that action. Then he wanted to see if he could reduce the tractor number further:

> Tractors 3 and see what happens

The program did not accept three tractors for the reason 'insufficient machinery'. He decided that he needed to have four tractors:

> We got to have four.

In this situation he used the immediate feedback given by the program to decide how many tractors were needed for the plan. After that he carried on making the rest of the plan for the farm.

The incidents cited above show how Steven reacted when the program rejected his actions. There was one occasion when he was not able to understand the reasoning given for rejecting his action. As with previous users, this may be partly due to the fact that the reason was not explanatory enough. However, Steven reconsidered his action. On all the other occasions, Steven understood why the program rejected his actions, and was able to select further actions. This observation is related to how he learned in the first session. Chapter 6 shows that Steven put in a lot of effort to learn from the program (Fig. 6.17), taking the third highest rank order.

Robert

Reflecting on his experience during the practice week, he mentioned some situations where the program did not allow his actions. He did not think that there was a valid reason for the program to reject his action:

> I think I put somewhere in my notes (the notes he kept during the practice week) that by changing something like oilseed rape to wheat, which is not cereals but it came up with something like "there wasn't enough conservation", I couldn't see the logic of it because I wouldn't have thought it would have affected it.

This particular situation he referred to occurred during the first session. Robert tried to change the cropping in field 6 to winter wheat at intensity 2. The program did not allow that action. The reason given by the program was that there was insufficient grazing if the proposed action was allowed. Then he tried to select oilseed rape at intensity 1 on the same field, instead of trying to grow winter wheat. The program rejected that action too, again the reason being insufficient grazing. At this point he chose to read more explanation about growing oilseed rape, and commented:

> I don't quite understand that because I was changing an arable crop and all of a sudden it was saying that I haven't enough grain. I wouldn't have thought it had an effect at all.

It appears that there was a clash between Robert's ideas and the assumptions built into the model of the program. He tried to execute his action again, whereupon the program again rejected the action, for the same reason. Then he tried to grow oilseed rape at a higher intensity, but the program rejected the action for the same reason:

> I can't really understand. .... . I can't see how it would have affected it.

Robert tried to execute his actions several times but without success:

> I can't understand why it keeps saying that 'insufficient grazing'.

He made a change according to the way he thought it should be done, but the program rejected his plan because the program thought otherwise. There was not enough information for him to understand the reasoning behind the program's feedback. The program should not only say that certain things cannot be done but also why these options are not possible.

At this point he wanted to go and look at the whole cropping plan for the farm.

> Is there somewhere it tells you your current cropping plan?

A list of current farm management actions was available in the program and it was possible to read the current cropping list within that list. Robert studied the current actions list before making another attempt. At this point, he stopped the first session.

He studied the program further during the practice week. When he came to the second session he perceived the problem he encountered as a limitation of the program:

> I think it is difficult thing to put together, I can well imagine that it is difficult to get everything exactly right

During the second session, Robert faced the first problem when he tried to put winter wheat at intensity one in field 3. The computer did not accept the new action, the reason was 'insufficient conserved fodder'. In response to that he took note and continued to make changes. After a couple of changes he faced similar problems when he tried to put winter wheat at intensity 2 on field 7. The program did not allow that action and the reason given was 'insufficient grazing'. Then he went to field 9 and tried to plan for oil seed rape there. Again the program did not allow the action due to insufficient grazing:

> 'insufficient grazing', oh dear!

He realised that his new farm management plan was going to result in reducing the grazing and conserved fodder for his cattle. He accepted the feedback given by the program:

> Oh! I think we have to go and do the grazing first, because it is .... it is not working this very much, so ... If I move there .. top

At this point he went back to the list of fields and started to put grass for grazing and 'graze and conserve' in a number of fields. Then he went back later to fields 3, field 7 and field 9, and successfully made the changes. The computer did not accept the changes he was making due to 'insufficient conserved fodder', six times altogether. Another reason he was not allowed to make a change was 'insufficient arable labour'. On all these occasions he made notes of the reasons and tried to make changes in order to accommodate his plans later.

During the second session Robert demonstrated a better understanding of how the program works. This observation is comparable with Robert's approach to learning from the program. Chapter 6 showed that Robert received the highest ranking for all the three sections. His ranking for the whole program was the highest (Fig. 6.17), suggesting that he engaged in deep learning.

Neil

Neil encountered the first problem when he tried to put winter wheat at intensity 1. The reason was that there was not enough conserved fodder. He put in another field for maize for conserving and went back to make his change in the same field. This time the program accepted his action. In this situation, Neil accepted the program's reaction and changed his actions accordingly.

The next time he faced a problem was when he tried to put field 33 into winter wheat at intensity 1. Due to insufficient arable labour in October the program did not accept the change. He tried to reduce the number of stock workers in order to employ more arable workers. The program did not allow him to reduce the stock workers – the reason was 'insufficient stock labourers in October'. In response to this he increased the student workers to two and tried to put field 33 to winter wheat at intensity 1 again. The computer did not accept the action and the reason was insufficient conserved fodder. In response to this he put a different field into maize for conserving which allowed him to get on with his action in field 33.

In this occasion too, he followed the feedback given by the program. However, later on he commented on the program not allowing him to reduce the stock workers and he was not happy:

> See that was another thing which, I dropped all that stock, 240 beef and try to reduce one of the stock labour and then I was going to put it on to the arable side ... .
>
> It wouldn't let me do that, so I just had to add one student to the arable side ... but in theory I should really have been able to ... . really if I got rid of all that enterprise, all that beef, the part of the person that was made available, say it was only half the person, which should have been enough to do extra arable ... .
>
> But it wouldn't let me do that see, so I had to employ an extra person, but if you think about it in real life that would be the case, wouldn't it?

According to his own experience as a dairy farmer he thought he should be able to employ the farm workers in a more flexible way, such as getting the stock workers to work on the arable side of the farm when they had finished milking, etc.:

> If you had a person who spent half the time doing beef and half their time, say working with the cows they could still work with the cows but when necessary they could have helped ... .
>
> You don't need two individuals ... . It would have been a waste, wouldn't it? I have employed an extra student for 47 hectares of winter wheat, which is what 100 acres, which is nonsense really, but then I must have freed up some time on the beef front ... .

It appears that there was a conflict between Neil's way of taking management decisions and the program's underlying assumptions on farm management. In order to solve this conflict the program should have the capability to provide more descriptive reasoning. On the other hand, by trying to understand about the farm and how the farm management decisions interact, Neil could have understood why his actions are rejected and how to overcome the problem. How he went about getting information from the program in the first session shows that he did not put much effort into learning. He ranked second lowest in Fig. 6.17 indicating that his approach to learning from the program co-relates with the observations in this section.

Duncan

During the second observation, Duncan entered a prepared farm management plan which he had tried out previously. So he faced no objections from the program to any of his actions. However, he mentioned some of the problems he had encountered during the practice week. Also he encountered some problems while doing the first session.

During the first session, Duncan wanted to make changes in the hedges and headlands, based on the feedback from the Nature Conservancy Council. Some of the options under this category were unfamiliar to him, so went on to get more information on them first.

After reading information he carried out the first action, laying hedges, whereupon he faced the first objection from the program, and the reason given was 'insufficient arable labour in March'. He wanted to read more information about laying hedges before accepting the program's feedback. He pointed out that he could not accept the reasoning given by the program:

> You don't cut it in March, you wouldn't cut it in March, so does it mean I can't do that then?

According to his own understanding the feedback given by the program was unacceptable. The program said that he could not lay hedges due to labour shortage in March. But he was not going to do that operation in March. So there was a conflict between the two – the farmer and the program.

However, Duncan tried to follow the direction given by the program. He realised that he needed to increase the labour:

> Two at the moment, so I'll have to go three first, before you actually?

But he didn't want to increase the labour number:

> No, I won't do that.
>
> So what can I do then, can I actually, if I wanted to cut it yearly? How do I actually go about doing it then? 'Cause it's obviously not going to accept it, unless I change labour first, is it?

It appears that there was a difference between the Duncan's model and the program's model of farm management.

After this incident he went on to read information on the farm workers. He learned that there were two arable workers on the farm but did not want to increase it:

> I don't particularly want to (increase the number) though, rather leave it, as it was

Afterwards he wanted to go back to the hedges and headlands and looked at more information on a few fields and paths. Consequently he included a new nature trail in his plan. He got rid of all the beef cattle. He tried again to execute the previous action which was rejected by the program due to labour shortage in March. This time the program accepted his action. This was because, by getting rid of all the beef cattle, he had released enough farm workers necessary for the new action. At the point he submitted the plan. These were the problems Duncan encountered during the first session.

During the second observation, Duncan did not face any problems.

Simon

The first time Simon had a problem was when he tried to put field 3 into spring wheat at intensity 2. The program did not allow that action saying that there was not enough conserved fodder:

> Oh, I can't start off doing that, can I? ... . It's bleeping at me saying I haven't got enough fodder.

At this point he accepted the feedback given by the program and decided on his next action:

> so I am going to have to cut my animals down first by the looks of it

He went to the livestock operations and reduced the dairy cattle, heifers below one year, heifers over one year, beef cattle below one year and beef cattle above one year. That allowed him to carry out his action later on.

There was another point when he expected the program to reject his action. He wanted to put field 36 to a camping and caravan site. As he was entering the selection he said:

> It's going to bleep in a minute, now

He was waiting for the program to reject his action. Instead it accepted his choice:

> No? Good old thing, otherwise I might have to go and change this.

He understood the way the program reacted to some of the actions he took and understood the reasons for that.

The next place he encountered a problem was when he wanted to manage 'scrub 2'. The program did not accept the choice, the reason being insufficient arable labour in October:

> Oh! bleep. I thought that was the, do nothing now
>
> I haven't got enough labour
>
> I thought it was coming, worth a try

He knew that the program would react that way. He did not strongly want to change the current action.

On the above occasions when the program rejected Simon's actions, he seemed to be agreeing with the reasoning given by the program. This behaviour is comparable with how he went about learning from the program, analysed in chapter 6. Simon ranked middle in terms of effort put into learning from the program (Fig. 6.17).

William

The program rejected William's action when he tried grow grass for grazing at intensity 2 on field 34. He read the reason for rejecting the decision, and said:

> 'insufficient conserved grass', but I am not going to feed. I knocked all the cattle out so there shouldn't be any reason to conserve any grass.

William was not able to understand immediately the basis for rejecting his action. He had already decided not to keep any cattle on the farm so he thought it is not necessary to have any conserved grass. He was going to have sheep on the farm, however, but was going to use some other feed for them. He took some time to look at how the program works and agreed to conserve grass:

So, we have to conserve some grass.

The next time when the program rejected his actions was when he tried to increase the number of sheep up to 950. He read the reason, and said:

Why? It doesn't it like it. 'Insufficient labour', well.

William appeared to agree, and said:

We'll go as far as we can go.

The next rejection was when he tried to grow sprouts at intensity on field 2. After reading the reason William agreed with it and wanted to try another option:

Oh I know. Let's have a large housing development scheme, see what happens then.

The above occasions show that William was able to understand the reasons why the program did not accept some of his actions. This observation is related to how he went about learning from the program. According to Fig. 6.17, he ranks in the middle in terms of the combined ranking.

7.12 Decision-making process

Martyn

Martyn submitted four plans spending nearly two and a half hours. His plans included 55 actions out of nearly 100 possible actions. Table 7.1 shows the categories that he changed (√).

Table 7.1: The categories Martyn changed

	Category	
1	Land use	√
2	Livestock operations	√
3	Farm workers	
4	Machinery requirements	√
5	Quotas	
6	Build barns for livestock	
7	Build extra milking parlour	
8	Build grain storage	
9	Houses	√
10	Managing scrubland	√
11	Paths	√
12	River and riverside	√
13	Managing Kingston Brake	√
14	Managing other woods	√
15	Hedges and headlands	√
16	Ponds	√
17	Ditches	
18	New farm enterprises	√
19	Disused railway station	√

Martyn started with the 'Land use' category. In soil grade 2 fields he selected actions from the top of the list. The program rejected some actions (discussed in Section 7.11), and in order to carry out his actions, he first went to the 'Livestock operations' category and made necessary changes there. In those fields where he did not make any changes, he still went through them and checked if the cropping was suitable for his overall plan.

Martyn's first plan consisted mainly of actions related to the 'Land use' and 'Livestock operations'. There were a couple of changes in 'River and riverside' and 'New farm enterprises'. While doing the changes in 'Land use' and 'Livestock' operations, Martyn did not have to seek more information, except when his actions were rejected. He had taken notes during the practice week which he used while making the plan. However, he sought more information about various options available in non-farming operations such as the 'River and riverside' and 'New farm enterprises'. After an hour and 15 minutes he submitted his first plan. After receiving feedback for it he made minor changes to the 'Landuse' category and completed his second plan.

Martyn's third plan contained new actions in other categories, and he took nearly an hour to complete it. He concentrated more on non-farming activities in the third plan. While doing the actions in the conservation and wildlife-related activities, Martyn sought more information about various options available to him.

It is possible to see a relationship between how Martyn used the program in the first learning session and how he chose his actions in the second session. In the second session, Martyn went through a logical sequence (a logical sequence is one in which actions are chosen on the basis of reasons derived from the information in the program) while making his plans. When he was not able to chose an action in 'Land use' category, he understood that he needed to make changes in 'Livestock' first, and did so. Afterwards he selected field by field and selected actions, without being rejected by the program. For those actions he knew little about, he sought information from the program. Overall, Martyn did not face major problems in completing his plans. Chapter 6 showed that Martyn put in considerable effort to learn from the program.

Tim

Tim spent 27 minutes and selected 14 out of nearly 100 possible actions. The 14 actions he chose were from 10 categories in the Plan. Table 7.2 shows the categories that Tim changed.

It is interesting to note that Tim did not want to make any decisions regarding 'Land use', 'Livestock operations' and 'Farm workers'. These are the main categories into which most of the pure farming operations fall. A comparative analysis shows that all the other users made changes in these three categories (except Neil who made changes in only two, the 'Land use' and the 'Livestock operations').

Table 7.2: The categories Tim changed

Category		
1	Land use	
2	Livestock operations	
3	Farm workers	
4	Machinery requirements	√
5	Quotas	
6	Build barns for livestock	√
7	Build extra milking parlour	
8	Build grain storage	√
9	Houses	√
10	Managing scrubland	
11	Paths	
12	River and riverside	√
13	Managing Kingston Brake	√
14	Managing other woods	√
15	Hedges and headlands	
16	Ponds	√
17	Ditches	
18	New farm enterprises	√
19	Disused railway station	√

Land use is the most time-consuming category from which to select actions; there are 47 fields on the farm further categorised into three different soil groups. In each field there is a range of crops to select from and a number of intensities at which to grow those crops. All the other users made selections within the category of 'Land use'. Depending on the number of changes they wanted to make they took different times. In order to make changes in the 'Land use' category, the user needs to have information on each field such as the current cropping, the size of the field and the soil group. This information is available from the Plan and could be taken during the first observation, the practice week, or the second observation while making the selections. Tim did not obtain this information during the first observation (Fig. 6.13 shows that Tim ranked lowest in terms of number of information sought). Neither did he make any attempt to get such information during the second observation. There was no recorded evidence, such as notes, that he had looked at the necessary information about 'Land use'. This may be why Tim did not make any attempt to change 'Land use'.

The same is true of the 'Livestock operations' and 'Farm workers'. In his first observation he did not look into these two categories. In fact he browsed only the category of 'New farm enterprises' once and the list of soil grade 2 fields once. Fig. 6.12 shows that Tim studied the least number of categories. There were no records of him getting this information during the practice week.

As for the actions he was going to chose, Tim faced difficulties reducing the number of tractors he was going to have on the farm. When he tried to reduce the number of tractors from five to two the program did not allow him to do that saying that there would be insufficient machinery for October. He protested, reasoning why he thought his action should be possible. However, he did not look at whether it was necessary to keep five tractors according to the current cropping programme on the farm. To understand this, he ought to have gone to the list of current actions and evaluated the situation closely. He did not choose to do that but had to leave the number of tractors as it was. Looking for more information on individual actions is an alternative way of making judgements about actions. Tim did not look for more information. Fig. 6.13 shows that he was the one who looked least.

It is questionable whether some of the actions he chose were based on logical reasoning. He chose to build 'Barns for 60 extra livestock'. It is difficult to justify this because he did not increase the number of livestock at all, prior to making this decision. Neither did he increase the livestock afterwards. Also it is difficult to justify the next change he made – increasing grain storage by 800 tonnes. As explained earlier, Tim did not change the cropping at all. In order to make informed decisions on the Plan section, one needs to collect enough information about the current situation of the farm. The data from the first observation reveal that Tim was not getting adequate information. Neither was there evidence in the form of notes. So Tim may have made some of the changes without thinking too much about the overall operation of the farm.

The next category where he made changes was in the 'Houses'. He looked at the list of houses and wanted to know more about the housing situation on the farm. This information is available within the program. One has to point to the line for which more information is needed and press the 'change' button on the tracker ball. It appeared that Tim did not really know that this information was available:

> Does that include the farm house, or farm house for the farm workers, do you think?

Following my suggestions he went on to read further information on houses and made his decisions.

Fig. 6.13 again shows this. Had he been used to going deep into the program and getting information he should have known how to access this information. He made changes to four houses, but still looked at more information only on a couple of houses. Also some of the changes he made are not compatible with the farm labour situation on the farm. He decided to rent three houses that have been currently tied to farm workers. The general guideline is to keep houses for the farm workers. Tim did not cut down on the farm workers, but still rented three houses that had been allocated for those workers.

Tim wanted to make a change for the next category 'managing scrub land'. When he tried to 'manage scrub 1' the program did not allow it, so he skipped it. Then he looked at 'scrub 2' and found that some options were not available. From what he said it appeared that he was looking at this information for the first time; he had not gone through it during the practice week. From this time on he continuously looked at more information on each of the actions he was going to carry out or avoid. It appeared that he had not gone through this information while he was doing the learning session by himself.

There appeared to be a relationship between how Tim selected the actions for the farm and his pattern of learning during the first session, analysed in Chapter 6. As far as the Plan was concerned, compared with the other farmers, he spent less time (Fig. 6.11); investigated fewer categories (Fig. 6.12), sought less information (Fig. 6.13), selected fewer actions (Fig. 6.14) and did not try to make a plan to see how the plan section worked (Fig. 6.15). He ranked lowest in term of the effort made to learn from the program (Fig. 6.17). In the second observation session, he did not carry out any actions in some of the major categories and did not have enough information to make informed judgements.

Steven

A striking observation during the second learning session was the extent to which Steven went on to comment critically on the situation on the farm. Specifically he was critical of some information presented in the Plan as well as other sections. He found out that there were two contrasting figures given for the number of cattle on the farm. According to him, the videoclip in the Office said that there were nearly 400 cattle on the farm whereas the figure given in the balance sheet shows that there were only 240 cattle available:

> I double checked it, that's why I queried it again this morning, with you, you see.
>
> See, everything is done as 240, on all the gross margin and everything, when he talks he said it is 400 there, and total of another 400, (counting) more than that, quite a few more followers, as a total of those three.

It appeared that Steven had gone through the information thoroughly. In order to prove that the figure given in the videoclip was wrong he made a few calculations based on the figures in the balance sheet. Also he replayed the videoclip in the Office. When the figures were given he stopped the tape and made his point:

> 400 you see

Then again he made a few calculations:

> The total number is the 400 dairy plus the followers on which gives the 120, 120, 120, so making it up to a total of 1300, which gives what it is 240, (calculating), and it is 720 you see as against only half the number basically.
>
> ... got 720, he is talking of different, in the computer it is down to 240 dairy cattle, he is talking of he has got 400.

Later he looked at the 'List' to see the number of dairy cattle. There were only 240 cattle in the list, and that proved his point:

> It is all there you see.

He also found some other misinformation:

> One of the acreages was wrong, couple of fields don't appear to know what crops are grown.
>
> Acreage was wrong on one definitely.

This kind of critical evaluation of information could be related to the way Steven went about getting information from different sections of the farm (analysed in Chapter 6). Fig. 6.1 shows that Steven spent a considerable time in the Walk. Also Fig. 6.4 shows that he did a thorough search of the fields he visited. In the Plan section, he ranked high in terms of the number of categories studied (Fig. 6.12) and the number of pieces of information sought (Fig. 6.13).

Another interesting feature observed just before Steven started to make his choices was the kind of opinions he was forming about the current situation of the farm. He was critical about the number of farm workers employed by the current farmer. He thought it was too many:

> That is exceptionally high, the farm workers, it is eight including the student.

Steven had more criticisms:

> ... there was so many acres of grass, he has got more acres of grass for 240 cows, so the whole thing is going to be ...

Based on his understanding of the farm he warned that he was not going to make a completely environmentally friendly business:

> Yes, I haven't made it completely worse but ...., not going to go very green unfortunately I think
>
> What I've seen of buildings there is no way, you will have to spend a lot of money on buildings if you are going to carry on with cattle, they carry such a vast overdraft (taking notes and showing) his interest is 45,000 a year! It is quite a big chunk, a big rent.
>
> If I was going to move in there the first thing I will do is to sell all the dairy to get rid of the overdraft, get a building permission there, certainly build a tourist centre there, put majority of it down to winter wheat, spring wheat, sheep and beef cattle.
>
> That is probably going to confuse the computer... (laughter),
>
> ... also develop this bit here (pointing to a location on the 'map') and I am not sure what houses I could sell.
>
> It won't come up very green but will come up more ... financially [successful] ...
>
> They make quite a reasonable profit. To say finance an overdraft of 45,000 a year is rather crazy giving it to the bank, you know.
>
> Best to get your house in order before you consider.... This area here develop more into an environmentally friendly with the grants available now and another bit here certainly not this here which they are talking about, they are talking about one of the better fields, suggesting for woodlands which is not really sensible. That is what I could best do.
>
> That is what I am going to do, certainly I am not going to give 45,000 a year to the bank

The way Steven assessed the current situation of the farm and formed his opinion about what kind of approach he was going to take indicated a comprehensive understanding of the farm. This kind of understanding is directly related to the way he used the Walk, the Office and the Plan in the first learning session.

Steven made 60 changes out of nearly 100 possible changes. He took nearly an hour and 15 minutes to make his farm management plan. Table 7.3 shows the categories Steven changed:

Table 7.3: The categories Steven changed

Category		
1	Land use	√
2	Livestock operations	√
3	Farm workers	√
4	Machinery requirements	√
5	Quotas	√
6	Build barns for livestock	
7	Build extra milking parlour	
8	Build grain storage	
9	Houses	√
10	Managing scrubland	
11	Paths	
12	River and riverside	√
13	Managing Kingston Brake	√
14	Managing other woods	√
15	Hedges and headlands	√
16	Ponds	√
17	Ditches	
18	New farm enterprises	√
19	Disused railway station	√

Steven started off with the 'Land use' category. In soil grade 2 fields he changed the cropping from the beginning of the field list. He changed the cropping programme in 36 fields out of the 47. In those fields where he did not make any changes, he still went through them and checked if the cropping was suitable for his overall new plan. Mostly he got rid of grass because he was going to reduce the size of the livestock operations on the farm. While doing the changes to the fields, where necessary, he went into the 'Livestock operations' category and made necessary changes there too.

While doing his management plan, he hardly went to look at more information, especially in the main categories such as the 'Landuse', 'Livestock operations' and 'Farm workers'. It appeared that he had gathered all the information necessary for making the plan. He went to look at more information only in a few cases when the program did not allow his actions. One instance was when he tried to reduce the number of stock workers. He looked at more information for stock workers and decided that he had adhered to the guidelines set out by the program.

The categories from which he obtained more information before making decisions were the 'Houses' and the ones related to the conservation aspects such as 'Managing Kingston Brake', 'Managing other woods' and 'Ponds'. With regard to 'Houses' he wanted to make decisions according to the special features of the houses and their locations within the farm. So he looked at more information for each of the houses and made decisions accordingly.

It appears that how Steven used the Walk, Office and the Plan sections to get information related to how he chose his actions during the second learning session. While he was selecting his actions for management of the farm, he worked through a logical series of steps, starting for instance from 'Landuse' and making selections in other areas when necessary. He did not face any major difficulties with his changes. There were occasions when the program did not accept his actions whereupon he looked for more information and altered his decisions. He started the session with a reasonable amount of information and understanding of the farm. The graphical representations of his approach to using the Plan (Figs. 6.1-6.17) provide evidence of this. In terms of the effort put into learning from the program, he ranked the third highest (Fig. 6.17). There was also recorded evidence: for instance Steven had made notes of information he needed for his actions. Overall Steven did the Plan section smoothly.

Robert

Robert's final plan consisted of 40 actions. He took 52 minutes to do his plan. Table 7.4 shows the categories he changed.

Selecting individual actions did not cause Robert any problems, during the second session. He started off with the 'Land use' category and chose actions. There were a number of occasions when the program did not allow his actions. Robert took notes of the reasons for not allowing those actions and made appropriate changes. For instance, when the program pointed out that there would not be enough grazing for cattle he increased the grazing before making any other changes. There were certain points, discussed elsewhere, when Robert did not agree with the reasoning given by the program. Completion of the 'plan' section did not appear to exhaust him:

> Right. That is it, ready to submit. If you are ready for a laugh!

After getting the feedback for the first plan he submitted, he changed some of the actions and submitted a second plan.

Table 7.4: The categories Robert changed

Category		
1	Land use	√
2	Livestock operations	√
3	Farm workers	√
4	Machinery requirements	
5	Quotas	
6	Build barns for livestock	
7	Build extra milking parlour	
8	Build grain storage	
9	Houses	√
10	Managing scrubland	√
11	Paths	√
12	River and riverside	√
13	Managing Kingston Brake	√
14	Managing other woods	√
15	Hedges and headlands	√
16	Ponds	√
17	Ditches	
18	New farm enterprises	√
19	Disused railway station	√

It appears that Robert's pattern of getting information from the three sections of the program correlated with the way he carried out his actions. Robert was the one who spent the longest time in the Office and Plan (Figs. 6.8 and 6.11) and second longest time in the Walk (Fig. 6.1). Also he had done a thorough search of the farm visiting the largest number of fields (Fig. 6.2), taking information from the largest number of sections within the Office (Fig. 6.9) and looking at the largest number of categories in the Plan (Fig. 6.12). Also his search was a more detailed one, as shown by Fig. 6.4. In the first observation he tried to get a better understanding of how the Plan section works (Figs. 6.14 and 6.15). This kind of information-seeking behaviour may have helped Robert to carry out his plan smoothly.

Neil

Neil's plan consisted of 19 changes that took him 35 minutes to put in. He changed the cropping of 7 fields out of the 47 on the farm. Table 7.5 shows the categories Neil changed:

Table 7.5: The categories Neil changed

Category		
1	Land use	√
2	Livestock operations	√
3	Farm workers	√
4	Machinery requirements	
5	Quotas	
6	Build barns for livestock	
7	Build extra milking parlour	

8	Build grain storage	
9	Houses	√
10	Managing scrubland	√
11	Paths	√
12	River and riverside	√
13	Managing Kingston Brake	
14	Managing other woods	√
15	Hedges and headlands	√
16	Ponds	√
17	Ditches	
18	New farm enterprises	√
19	Disused railway station	√

Neil took a different approach to making his plans. He wanted to change the livestock operations before doing anything to the cropping plan:

> First thing I want to change is livestock I think. Can't do land until I've done livestock, I've found.

From the learning experience during the week he had worked out a strategy for making inputs to the program. From then on, he changed first some of the livestock operations on the farm. He got rid of all the beef cattle below one year and all the beef cattle above one year. Then he went to 'Land use' and started to make changes. When he selected certain options, the program objected but he was able to continue. He took nearly 19 minutes to make changes in the 'Land use' category, but he did not have to look at more information on fields or individual cropping – he had already taken notes on more information during the practice week. Afterwards he said he was not going to make a lot of changes to the existing plan. He looked at more information just once while making selections on conservation aspects of farm management.

Duncan

Duncan made 33 changes into his plan taking 37 minutes. Table 7.6 shows the categories he changed:

Table 7.6: The categories Duncan changed

Category		
1	Land use	√
2	Livestock operations	√
3	Farm workers	
4	Machinery requirements	
5	Quotas	
6	Build barns for livestock	
7	Build extra milking parlour	
8	Build grain storage	
9	Houses	√
10	Managing scrubland	√
11	Paths	√
12	River and riverside	√
13	Managing Kingston Brake	

14	Managing other woods	√
15	Hedges and headlands	√
16	Ponds	
17	Ditches	
18	New farm enterprises	√
19	Disused railway station	√

In his plan he changed the cropping in 23 fields out of the 47 fields on the farm.

Duncan explained how he went about choosing actions. He first tried to select a few actions and see the effect on mostly the financial success of the farm. He took notes of the original figures and compared them with the new figures:

> I was writing on this paper as I went along, yes, then I made some more changes ... .
>
> Then I saw, went to the Office and saw what I'd done to the finances, like that, just jotted down some of them.
>
> Then I made just one or two changes, like I changed field 3 to winter wheat, that showed gross margin changed to that, it had gone up by an extra amount, I was trying to work out, I isolated my two individual actions to see what effect they had.
>
> Then when I got that far, I went through all of the interested groups, made some conclusions from that, then I did some more changes, this is where I was trying to work out what effect the set aside had, so then I didn't know at that time I didn't realise that set aside wasn't compulsory,
>
> So I changed that, changed it back again, changed it back again, then I changed from, the disused railway station from building workshop to convert to new workshop to see what effect that had, and I think, one of the pressure groups, if there was any change they like it slightly better, in that way, but the District Council still wouldn't give me planning permission for it. ... . He didn't like it.
>
> (looking at the notes) Lastly I changed another field there, that was a crop field, back it back to wheat, then I changed a house six from rent as residential holiday cottage to rent to a local, thought that might please the certain Parish Council, but it didn't... .

Duncan had studied the program in-depth during the practice week and submitted several plans. In the second session he put the final version of his farm management plan into the program, which he had word-processed already. While doing the plan he did not face any objections from the program, nor did he look at more information. This pattern could be related to the way he had sought information from all the three sections. Fig. 6.18 shows that Duncan ranked second highest in terms of the effort put into learning from the program. He spent considerable time on the program, studying it deeply and in detail.

Simon

Simon did 49 changes that took 55 minutes. Table 7.7 shows the categories he changed:

Table 7.7: The categories Simon changed

Category		
1	Land use	√
2	Livestock operations	√
3	Farm workers	√
4	Machinery requirements	
5	Quotas	√
6	Build barns for livestock	
7	Build extra milking parlour	
8	Build grain storage	√
9	Houses	√
10	Managing scrubland	√
11	Paths	√
12	River and riverside	√
13	Managing Kingston Brake	√
14	Managing other woods	√
15	Hedges and headlands	√
16	Ponds	√
17	Ditches	
18	New farm enterprises	√
19	Disused railway station	√

There were changes to 26 fields out of the 47 on the farm. On two occasions the program rejected his actions. He did not look at more information while doing the plan. Selecting the actions was a smooth process.

Simon explained that during the practice week he went on the Walk again gathering more information about the farm. This gave him some ideas for possible actions. He then made a few changes and received feedback.

> then I submitted the plan, and obviously there wasn't a great change with anything I had done, everything came up virtually the same, I hadn't made alterations to the fields or stocks

Based on the feedback from the interest groups he changed his plan:

> Well I did a few (submitting as I was going along), I did about five or six changes, there was very little difference on them, there wasn't everything came up with no little change in it, only minor.
>
> Yes, so then I thought I got to get a bit more methodical about it, so I started at the top of the list
>
> Yes, went through all the fields, what soil types they were, what you could grow on them, flicked through all of those, (get the field sizes as well)
>
> So I knew what I could grow, where I could grow it, had an idea how many cows I wanted to keep, I wanted to cut the cows back and the beef back, release some quota which would hopefully raise me some money to do these other changes, which it did.

He sought more information where necessary:

So I knew how many cows, the stock I was keeping, so then I worked out how much grass I felt personally it needed

So I knew I had to keep grass on certain fields cause it wouldn't grow anything else, I then had to add extra grass on some other fields because there weren't enough grass on the field, you could only grow, then I just arable cropped the rest

So that was then my basis of my plan

From that and then it released enough money to do all the other bits and pieces, while the computer keeps bleeping at me.

Four times (submitted plans) I think, but on the last time I only changed a couple of things, just to keep the country, I did more to the scrub, 'cause the Countryside and, who else was it, yes the Nature Conservancy and the Wildlife Advisors on my last submit weren't particularly happy so I changed a couple of things, like, what did I do, I managed some scrub better, and forgot what else I did (looking at the notes for some time),

I changed in Kingston Brake I cut out, I had just put improve the rides but I changed that to coppice on a short rotation, and the other woodland I also had, thin out the woods to a high forest, and I changed that to coppice to a short rotation, but when I submitted those before they weren't the most beneficial thing, I didn't appear to have enough labour or something to do it, but on my final submission, obviously I had

The way Simon took information from all the sections may have influenced how he was able to do the actions. Fig. 6.17 shows that he made considerable effort to learn from the program.

William

William submitted five plans consisting of 55 actions. He took about an hour and 40 minutes for this. Table 7.8 shows the categories he changed:

Table 7.8: The categories William changed

	Category	
1	Land use	√
2	Livestock operations	√
3	Farm workers	√
4	Machinery requirements	√
5	Quotas	√
6	Build barns for livestock	
7	Build extra milking parlour	
8	Build grain storage	√
9	Houses	√
10	Managing scrubland	
11	Paths	√
12	River and riverside	√
13	Managing Kingston Brake	√
14	Managing other woods	√
15	Hedges and headlands	
16	Ponds	√
17	Ditches	
18	New farm enterprises	√
19	Disused railway station	√

Before selecting any actions, William mentioned that he has little experience in dairy and beef farming. He is an arable farmer. This was reflected in how he started to select actions. First he selected the 'Livestock' category and got rid of all the dairy and beef cattle. Afterwards he went to the 'Landuse' category, and starting from the top of the list, selected actions. Even if he did not select actions for some fields, he still checked whether the current cropping plan was suitable for the overall plan. Especially while making the later plans, most of the time he looked at all the options available for each action he was going to select. He also sought information about available options.

As Table 7.8 shows, William concentrated only on actions related to 'Land use' and 'Livestock operations' in his first plan. In his second plan, too, he concentrated on similar actions but included more categories. However, in his third, and fourth plans he included actions related to local economic aspects and the environment. Chapter 8 includes the details of these variations and reasons behind them.

Overall, William completed five plans smoothly. His pattern of leaning from the program, reflected in the first session and analysed in Chapter 6, seemed to be related to the way he carried out the second session. Fig. 6.4 shows that he ranked the second highest in terms of the number of level-2 walks (detailed information gathering). He ranked middle in the overall combined rank order for the Office (Fig. 6.8), the Plan (Fig. 6.16) and the overall program (Fig. 6.17). How William went about making his decisions is related to how he learned from the program.

7.2 Conclusion

This chapter analysed how the farmers arrived at their farm management decisions. For each farmer the analysis was focused on two aspects:

- how the farmers reacted when the program did not allow their decisions
- how the farmers' decision-making process was influenced by their particular approach to getting information

When the program did not allow farmers' actions, especially during the first session, they disagreed with the reasoning given by the program. They questioned the validity of the reasoning. However, this situation prompted them to re-think their actions. They went on to read more information in these particular situations. They made an effort to understand why the program rejected their actions. In some cases the program was successful in providing enough information, and the users changed their decisions. However, there were occasions when the users held on to their views. This is partly due to individual users' learning approach – some of them did not have an adequate knowledge of the farm in order to judge the program's behaviour. Those who understood the program's behaviour faced fewer rejections during the second session.

There appeared to be a relationship between the users' approach to getting information from the program and how they made their decisions. Those who spent more time and made considerable effort to take information from the program during the first session appeared to go through the Plan in detail and select more actions from more categories and spend more time on the task. Also they showed a better understanding of the information necessary to make the farm management decisions. Those who put in considerable effort and took a 'deep' approach to learning appeared to understand the behaviour of the program better when they came to the second session, and they faced fewer objections to their actions. They demonstrated a better rapport with the program.

Chapter 8 focuses on the plans farmers submitted and analyses how the farmers evaluated their plans.

Chapter 8
The main study: the farmers evaluating their plans

After making their farm management decisions, the farmers submit their plans and receive feedback. These plans are the final product of their learning sessions, and can be used to get an insight into the learning outcome. The chapter analyses:

- the outcome of plans and how it is influenced by the approach to learning, and
- the farmers' reactions to the feedback and its implications for learning from the program

8.1 The analysis

The analysis of the outcome of plans will reveal how the farmers' particular approach to learning influenced their decisions. The analysis of users' reactions to the feedback will point towards important issues related to farmers' learning from computer-based media. The individual cases are analysed separately.

8.11 The outcome of plans

Martyn

Martyn produced four plans for which he received feedback. Table 8.1 shows the summary of feedback from the interest groups on the 'television'.

Table 8.1: A summary of the feedback received by Martyn

Interest group	1st set of feedback	2nd set of feedback	3rd set of feedback	4th set of feedback	In general
Nature Conservancy Council	decrease the wildlife; have another look	decrease the wildlife; have another look	decrease the wildlife; have another look		negative
Countryside Commission	produce some changes; have another look		produce some changes; have another look		neutral
Rural Development Commission	excellent; great success		excellent; great success		very positive
District Council	too many changes; alter		too many changes; alter	too many changes; alter	very negative
MAFF	OK; reasonable				neutral
National Farmers' Union	reasonable; quite satisfactory		reasonable; quite satisfactory		positive
Enterprise Consultant	very pleased; you agreed with us		very pleased; you agree with us		very positive
Rambler	not too happy; haven't done any changes		pretty good; thanks for improvements		very positive
Wildlife Advisor	sorry; causes problems to wildlife		sorry; causes problems to wildlife		very negative
Parish Council	well done; but could do just a bit more		congratulations; well done		very positive
Trade Union	pleased to see that there will be more jobs		pleased to see that there will be more jobs		very positive
Local	thanks; plan suits us		thanks; plan suits us		very positive

The responses Martyn received for his overall plan could be quantified as:

very positive	6
positive	1
neutral	2
negative	1
very negative	2

The feedback from the interest groups for Martyn's overall plan consisted of more positive responses than negative responses. There were 7 responses on the positive side and 3 on the negative side. Two negative responses were from the interest groups that are concerned with nature and wildlife, suggesting that his plan was not environmentally satisfactory. However, the interest groups concerned with local economy, jobs, housing and financial profitability favoured his plan. Preparing this kind of a plan seem to match Martyn's pattern of investigation in the first session analysed in Chapter 6. He put in considerable effort to learn from the program, and ranked middle in terms of the overall combined ranking for the program (Fig. 6.17).

Tim

Tim's plan produced a balance sheet with increased nett worth and decreased total assets. Table 8.2 summarises the feedback from the interest groups on the 'television'.

Table 8.2: A summary of the feedback received by Tim

Interest group	Feedback	In general
Nature Conservancy Council	some improvements, might look at the plan again	neutral
Countryside Commission	fairly good, might look at the plan again	neutral
Rural Development Commission	some changes, might look at the plan again	neutral
District Council	too many changes, change your plan again	negative
MAFF	looks OK, but do you think the balance is right?	neutral
National Farmers' Union	reasonable; quite satisfactory	positive
Enterprise Consultant	pleased	positive
Rambler	pretty good; thanks	very positive
Wildlife Advisor	pleased; good	very positive
Parish Council	not too happy	negative
Trade Union	in the right direction, more could be done	positive
Local	haven't been listening to us; no more jobs and houses; look again	very negative

The response Tim received could be quantified as:

very positive	2
positive	3
neutral	4
negative	2
very negative	1

The very positive responses were from the Rambler and the Wildlife advisor. There could be two reasons for this type of response. One is related to the changes he made in 'River and riverside', 'Managing Kingston Brake', 'Managing other woods' and 'Ponds'. The other reason could be the changes Tim was not responsible for. The kinds of crops selected and the cropping intensity have a direct influence on wildlife on the farm. Tim did not make any changes to the cropping on the farm. So perhaps some of the positive responses are automatically carried over from what Tim did not change. So it is not possible to estimate how far Tim's actions are responsible for the positive feedback.

Among the positive responses, one is from the NFU representative. This response is based on the financial gain he made. The main reason for Tim's financial success is the sale of two houses. He did not make any changes to the cropping, livestock and labour that would have changed the profit and loss situation drastically. Another positive response was from the Trade Union representative. Here too it is the previous plan that has been commended rather than Tim's own selection of actions.

How does the final outcome of Tim's plan relate to his approach to learning from the program? Though a number of interest groups favoured his plan, most of the actions that were responsible for the positive outcome were carried over from the previous (default) plan. There were a number of crucial categories he did not bother to look at or change. After all, he did only 14 actions. Fig. 6.17 shows that Tim ranked lowest in terms of the effort put into learning from the program. Tim spent less time and studied the program at a 'surface' level. Though he got positive responses, he is not responsible for those actions. A very negative comment was from the local person. It is possible to say that this is directly related to the changes Tim made to the housing situation, i.e., selling two houses.

Steven

Steven's plan had a successful financial outcome. There were huge increases in gross margin, the net worth and the bank balance. According to the opinions he expressed before beginning the learning session his determination was to improve the financial situation and to do few conservation related activities. Steven had made changes in all the major farming enterprises. So it can be assumed that the changes in the financial situation was a direct result of all the actions he choose. After receiving feedback for his first plan, he made a few changes and submitted another plan. Table 8.3 shows the feedback he received for his plans. The two sets of feedback are recorded in two columns.

Table 8.3: A summary of the feedback received by Steven

Interest group	1st set of feedback	2nd set of feedback	In general
Parish Council	doesn't like	--	very negative
Wildlife Advisor	very sorry, not good at that	very sorry, not good at that	very negative
NFU	very satisfactory	very satisfactory	very positive
MAFF	OK, do you have the balance right?	OK, do you have the balance right?	neutral
Nature Conservancy Council	oh dear, complete disaster	oh dear, complete disaster,	very negative
Rural Development Council	excellent		very positive
Countryside Commission	could produce some results, might look at the plan again	could produce some results, might look at the plan again	positive
District council	too many changes	too many changes	very negative
Enterprise Consultant	very pleased	very pleased	very positive
Naturalist	not too happy, please try again	not too happy, please try again	negative
Trade Union	pleased	pleased	very positive
Local	not pleased, go and change	--	negative

The responses Steven received for his overall plan could be quantified as:

very positive	4
positive	1
neutral	1
negative	2
very negative	4

It is interesting to see how the feedback is polarised, with four groups/individuals very positive and four very negative. The very positive feedback was for the financial success, the enterprises and the development work he was planning to carry out on the farm. The negative remarks were due to the degradation of the environment and less focus on local aspects in his plan. Even though Steven tried once to get some positive feedback from the environmental groups, he was not successful. However, he had achieved the target he set up earlier, i.e., 'best to get your house in order before you consider.., not going to go very green ... .', according to his own words.

He spent considerable time on the Disc during the first and the second sessions. Also he used it during the practice week. Steven was ranked in the middle in terms of effort put into learning from the program (Fig. 6.17), and his plan produced the kind of results he wanted.

Robert

Robert's plan also made a reasonable financial success. His bank balance, farm gross margins and the nett worth went up. Table 8.4 shows the list of feedback he received for his plans.

Table 8.4: A summary of the feedback received by Robert

Interest group	First set of feedback	Second set of feedback	In general
Nature Conservancy Council	some improvements; some increases; might look it again	well done	very positive
Countryside Commission	congratulations; great success; pleased	congratulations	very positive
Rural Development Commission	some changes; some prospects; just look at it again	produce some changes, but more to do; just look at plan again	neutral
District Council	too many changes	too many changes	very negative
MAFF	OK, but is the balance right?	--	neutral
NFU	not too bad	--	positive
Enterprise Consultant	very pleased	--	very positive
Naturalist	pretty good	pretty good	very positive
Wildlife Advisor	very pleased	very pleased	very positive
Parish Council	pleased; congratulations	congratulations	very positive
Trade Union	pleased	--	very positive
Local	thanks	--	very positive

The responses could be quantified as:

very positive	8
positive	1
neutral	2
negative	1
very negative	0

The striking feature is how the feedback is shifted towards the positive side: there are nine responses on the positive side and one on the negative side. Out of the nine positive responses, eight were very positive ones. This shows that Robert's final plan was a very successful one in all three respects – financial, environmental and village economic. This successful plan is well related to the pattern of investigation within all three sections of the program. Robert ranked highest in terms of efforts made to learn from all three sections and the program as a whole (Figs. 6.10, 6.16 and 6.17).

Neil

Neil's plan was financially unsuccessful. After planning changes, he was making less profit. Table 8.5 shows the list of feedback he received for his plans.

Table 8.5: A summary of the feedback received by Neil

Interest group	First set of feedback	Second set of feedback	In general
Nature Conservancy Council	some improvement, might look again	--	neutral
Countryside Commission	might be OK, but have another look	--	neutral
Rural Development Commission	excellent	--	very positive
District Council	too many changes; no	too many changes, no	very negative
MAFF	looks OK, but is the balance right?	--	neutral
NFU	real problems, ought to look again	real problems, ought to look again	very negative
Enterprise Consultant	pleased	--	positive
Naturalist	pretty good: thanks	--	very positive
Wildlife Advisor	pleased	--	very positive
Parish Council	well done	--	very positive
Trade Union	pleased	--	positive
Local	really suits	--	very positive

The responses could be quantified as:

very positive	5
positive	2
neutral	3
negative	0
very negative	2

Neil's actions produced a plan that received a mixture of responses, from very negative to very positive. However, there were more positive ones than negative ones. An important negative response was from the NFU representative who was concerned about the financial situation and advised him to look at the plan again. He wanted to assess his financial situation but found that he had not collected enough information about farm accounts. The Office section is where one could access such information. Fig. 6.8 shows that Neil did not spent much time in the Office and he did not look at the financial information at all.

Neil scored on other fronts though he was not successful financially. He got very positive responses from the Ramblers and the Wildlife Advisor. The responses from the Nature Conservancy Council and the Countryside Commission were neutral. Neil seemed interested in wildlife: Fig. 6.7 shows that Neil was one of the two users who spend most of their time investigating the wildlife in the Walk section.

Duncan

Duncan's actions produced a financially sound farm management plan. For instance the net worth went up. The feedback from the interest groups provided positive results, too. Table 8.6 shows the list of feedback.

Table 8.6: A summary of the feedback received by Duncan

Interest group	Feedback	In general
Nature Conservancy Council	some improvements, might look again	neutral
Countryside Commission	OK, but might look again	neutral
Rural Development Commission	excellent, right in line with our thinking	very positive
MAFF	OK, but is the balance about right?	neutral
District Council	too many, can't give permission, make fewer	very negative
NFU	reasonable, things are satisfactory	positive
Enterprise Consultant	pleased	very positive
Naturalist	looks pretty good, thanks	very positive
Wildlife Advisor	very pleased	very positive
Parish Council	not happy; fewer jobs and new houses	very negative
Trade Union	OK, there will be more job opportunities; a bit more could be done	positive
Trade Union	thanks, quite suit us, could do a bit more	positive

The feedback could be quantified as follows:

very positive	4
positive	3
neutral	3
negative	0
very negative	2

Duncan had scored 7 positive responses of which four were very positive ones. His balance sheet was not particularly good, however, the reason being that his farm management plan was not entirely financially driven. The positive feedback was from conservation-related groups and those who were concerned with the local aspects. The only exception was the Parish Council which complained that there would be fewer jobs and new houses according to Duncan's plan (this situation is discussed elsewhere). Overall, Duncan's plan produced a balanced outcome, which is in line with the way he sought information. Duncan ranked second highest in terms of effort put into learning from the program (Fig. 6.17). He seemed to have achieved the learning objective of the program.

Simon

Simon's plan was financially not successful according to the spokesperson for the National Farmer's Union, although he did not agree with that opinion. Table 8.7 shows the list of feedback he received from the interest groups.

Table 8.7: A summary of the feedback received by Simon

Interest group	Feedback	In general
Nature Conservancy Council	some improvements; might look again	neutral
Countryside Commission	congratulations; great success	very positive
Rural Development Commission	excellent; right in line with our thinking	very positive
District Council	too many changes; make alterations	very negative
MAFF	OK, but is the balance right?	neutral
NFU	seem to have some problems, might look again	negative
Enterprise Consultant	very pleased	very positive
Naturalist	pretty good; thanks	very positive
Wildlife Advisor	pleased	very positive
Parish Council	congratulations, well done	very positive
Trade Union	pleased; wish well	very positive
Trade Union	thanks	very positive

The kind of feedback could be quantified as follows:

very positive	8
positive	0
neutral	2
negative	1
very negative	1

It is striking to see the number of positive responses Simon received. There were eight very positive ones. One of the two negative responses was from the NFU who warned him that his balance sheet was not healthy. Simon disagreed with this and claimed that his own analysis of financial figures from the 'Computer' in the Office proved otherwise (discussed in Section 8.12).

The positive responses were from environmental groups and those concerned with the rural economy. Apart from the complaints by the NFU, Simon was happy about the outcome of the plan. This situation can be attributed to the way in which he used the program. Simon ranked in the middle in terms of effort he made to learning from the program, as Fig. 6.17 shows.

William

William prepared five plans, and received feedback for them. Table 8.8 shows the summary of feedback he received for his plans.

Table 8.8: A summary of the feedback received by William

Interest group	1st set of feedback	2nd set of feedback	3rd set of feedback	4th set of feedback	5th set of feedback	In general
Nature Conservancy Council	some improvements; might look again			some improvement; might look again		neutral
Countryside Commission				congratulations; great success		very positive
Rural Development Commission				some improvements; might just look again		neutral
District Council	free to go ahead without reference to us		too many changes; go back and alter	no because of the large housing development		very negative
MAFF	OK; reasonable					neutral
National Farmers' Union	real problems; really ought to look again			balance sheet looks very good		very positive
Enterprise Consultant				very pleased		very positive
Rambler				pretty good; thanks		very positive
Wildlife Advisor				beneficial; you've done reasonably well		positive
Parish Council	not too happy; fewer jobs and new houses; reconsider		no real changes to improve jobs and houses	congratulations; positive actions has been taken		very positive
Trade Union	no new job opportunities; look at the plan again	no new job opportunities; look at the plan again		wish you well; pleased		very positive
Local				your plan is going to make things worse	not much difference; look again	very negative

The kind of feedback could be quantified as follows:

very positive	6
positive	1
neutral	3
negative	0
very negative	2

William's feedback is towards the positive side, with seven positive and two negative. This suggests that William's overall plan has been favoured by interest groups. These positive responses can be related to William's pattern of getting information from the program, as analysed in Chapter 6. William was ranked in the middle in terms of effort to learning from the program (Fig. 6.17).

8.12 Farmers' reactions to the feedback

Martyn

Looking at financial results

Martyn looked at all four farm accounts in order to understand the results of his plan. While looking at the farm accounts he commented on what he saw on the screen:

> I got miscellaneous revenue you see.

While looking at fixed cost, he realised that his bank overdraft had gone up:

> Bank is not very happy. ... . I presume the bank balance. I have overdrawn the balance, but I have a change in Nett worth

The balance sheet for the farm provided information necessary to evaluate the overall success of his plan. Martyn continued to comment on the figures:

> Total assets increased
>
> The building value (income from converting farm buildings) has gone up.
>
> The machinery has depreciated, so I would have expected a lower figure there.

In his plan, Martyn did not include any beef or dairy cattle. He only had sheep. He realised that the income from livestock had gone down:

> The livestock, because I have only got, I sold the beef so I have that as an income, but the closing valuation is lower, 100,000.

However, due to the changes in cropping, he made additional income:

> The crops have gone up from 10,000 ... . They have gone up 50,000.
>
> The value of the quota has not changed.
>
> What has gone up is bank overdraft. Mortgage has come down.

> The loans come down. Trade creditors are the same but the bank overdraft is gone up.

Finally he was satisfied that his nett worth had increased and was satisfied about the results:

> We've (the nett worth) gone up from 2,600,000 to 3,047,000.

Afterwards he selected the 'television' to listen to feedback from the interest groups:

> Right now, let's hear what they say.

Listening to interest groups

The first feedback Martyn received was from the spokesperson for the locals who commented positively about the plan. However the spokesperson said 'but you could do a bit more'. Martyn said what the locals want more is to convert the old railway station to a community centre:

> (Laughter) He wants the community centre. There is an option to convert the old railway to a community centre, but you got to get some income before you get some money out because there is no income from that.

Martyn had considered creating a community centre in the old railway station, and had read more information about it while doing his plan. He was sceptical about the option because it would not bring in income. However, he went on to read textual information attached to the videoclip.

He received feedback from Trade Union and Parish Council representatives who favoured his plan. He did not comment on them. However, when he received the feedback from the Wildlife Advisor, which was negative, Martyn commented:

> I knew it comes somewhere. ... . If you haven't got any money you can't [do].... anything [to improve wildlife]

The next comment was also negative, from the spokesperson for the Ramblers. Martyn went on to read more information about what the Ramblers suggested he should do. Another negative response was from the District Council person who said the plan could not be approved unless Martyn made fewer changes. Martyn read more information about the comment and considered the reasons for the negative feedback:

> I may have changed too much too soon.
>
> I have done the barn there, the workshops and the farm buildings, the old railway line, you see, I would have thought it would have been a housing situation rather than workshops,
>
> I might have to withdraw that ... .

The next two feedbacks were positive, and Martyn did not comment. Afterwards he commented when he received negative feedback from the spokesperson for the Nature Conservancy Council:

> The wildlife and environmental people are not [happy] ... . What I have done was I altered the level of intensity on some of the fields.

Martyn thought that the reason for the negative feedback from the interest groups concerned with wildlife and the environment was due to the high intensity cultivation he proposed for some fields. The higher the intensity, the greater will be the inputs such as fertiliser, pesticides and weedicides, which is harmful to the wildlife. After listening to the interest groups, Martyn went to the Walk section to access the damage to the wildlife.

Looking at the wildlife

Martyn went to four fields on the farm where he selected actions. On field 47 he had converted a barn into a tourist centre. The screen showed that the numbers of wildlife had dropped; Martyn had difficulty understanding why:

> I don't know how converting to barns changed all that ... .

On field 47 too the numbers of wildlife have reduced. Martyn thought he could change the situation:

> I twigged it, might go back on that you see ... .
>
> I suppose I could do that, couldn't I? And see what effect that has.

Afterwards Martyn went back to the Plan to prepare a new plan.

Changing the plan again – the second plan

Martyn reduced the intensity of cultivation on fields 41, 42 and 46. By reducing the intensity, he thought he might get a favourable response from the environmental groups. Afterwards he listened to the feedback again.

Listening to feedback

Martyn listened to the spokesperson for the Nature Conservancy Council, who was still negative about his plan. Martyn thought that was unfair:

> It is the same again, He hasn't taken anything into account what I have done, has he? ... . I changed the intensity of the grazing, and changed from conservation to graze and conservation.

Later Martyn realised that perhaps he needed to change intensity of more fields:

> Not enough to make any difference.

He went to the Walk to investigate the effect of his actions on wildlife.

Looking at the wildlife

This time he visited 8 fields and assessed the changes in the number and diversity of wildlife. Afterwards he decided to go to the Plan again and make changes to his plan.

Changing the plan again – the third plan

Martyn took nearly an hour to do his third plan. This plan consisted of actions in more categories than his previous two plans. His first plan consisted of actions mainly in 'Landuse' and Livestock operations' categories. In addition, there were a few actions in 'River and riverside' and 'New farm enterprises'. The second plan consisted of actions only in 'Landuse'. It appeared that the feedback from the interest groups and his own assessment of wildlife prompted him to think about taking actions in more categories. His third plan included more categories related to the environment and the local economy. It appeared that Martyn was trying to improve his plan. After submitting the third plan, he went to see the financial results.

Looking at financial results

It appeared that Martyn's efforts to improve the plan paid off financially. The gross margins had gone up:

> Oops! Improved the gross margin by 300,000 pounds!
>
> Forage costs come down
>
> Miscellaneous revenues hasn't altered, purely forage costs

The information about fixed costs showed more details:

> Oh, my machinery (cost) has go down a bit
>
> Interest is gone up.
>
> Profits come down.
>
> Nett worth has come down quite a bit.

After that he wanted to receive feedback from the interest groups:

> We'd better hear what they have got to say.

Listening to the interest groups

The feedback from the Nature Conservancy Council was still negative; Martyn thought it was unfair. The feedback from the Countryside Commission remained the same, neutral. Martyn's reflected on the responses:

> They both said the same thing before. ... . Could have been worse, but it could be better.

The other negative response was from the District Council person who said that Martyn had planned too manychanges so the Council could not grant permission. Martyn agreed:

> There is too much to take on board in one go, isn't it? for the Council

The spokesperson for the Ramblers had changed his view on Martyn's plan this time, and favoured it. However, the Wildlife Advisor's negative feedback remained the same. Martyn thought they would have different views:

> It doesn't tally with the last one, does it?

Most of the positive responses remained the same except that the Parish Council's feedback changed from positive to very positive. It appeared that Martyn had improved his plan.

Martyn reflected on why the plan drew more positive responses:

> I changed some of the woodland work and the pond work [and] riverside path. Beg pardon, conducted tours, I did that, no that did not come into account, there must be something else I did. ... . Make riverside path

Martyn was thinking of other possible ways of improving the plan:

> Council might well not allow that planning permission, on that small development
>
> The only other way ... is to sell a house and knock the land plot for building. That's the other option that I had up my sleeve, as it were.
>
> That's what I would look at, but we haven't got time to do it. Possibly not sell that piece of land and sell one of the houses. That will probably help the cash flow.
>
> There are three houses let at the moment. I changed one of the lettings from a holiday let to a local let. So there are three locally let. Or you have to sell one of the houses for capital probably.

Changing the plan again – the fourth plan

Martyn did a few more changes such as selling a house and keeping the plot proposed for housing development. He then listened to the interest groups.

Listening to interest groups

Martyn listen to the spokesperson for the District Council to see if he was happy about the plan. The response remained negative, because there were still too many changes in Martyn's plan. At this point Martyn was unhappy because he thought he had made the necessary alterations:

> He has not changed his tune a bit!

Martyn's second learning session lasted for more than four hours. During this time, he prepared four plans and received feedback for them. He tried to relate the feedback to the actions he selected. On some occasions, it was not possible to find out the reasons for the negative feedback. But he reflected on the action he took and made an effort to understand the reasons for the feedback. The feedback prompted Martyn to change his actions and select new actions, leading him to submit four plans.

Tim

Looking at the financial results

Tim was happy about the favourable financial outcome of his plan:

> I think it's gone up, yes, the net worth's gone up.

Tim tried to analyse the results and to find reasons for the changes. Tim realised that selling two houses and renting out another two houses contributed to this difference. Since he did not make any changes to the cropping and livestock management, the income from those two sectors remained the same:

> Yes, the net worth's gone up, even though the total assets have gone down from opening into the closing, I think that's probably due to the selling of the couple of houses that I put in [the] plan.

His bank account went from a credit of £5,000 to £351,000 , due to the selling of two houses.

> And, you know, that they weren't being used, I'd already rented quite a lot of houses and, yes, you see the bank overdraft with in the opening was 5,000. ... [now] it's 351,000. I think minus means that you are back into a credit situation.

In his plan, he converted the disused railway station into a workshop. The financial figures showed that the value of the property had gone up, and he tried to find the reason for that:

> ... you have changed the valuation of the disused railway station, and your cash flow I assume, by not having it used at all you are not earning any money from it, because I changed it to a workshop, it looks as though it (is) bringing in another 40,000 pounds.

Two other main changes he made were allowing shooting in woodlands and allowing fishing in the river. He attributed some of the increases in income to these changes:

> Yes, the same with the shooting, that's... . Yes, I allowed the shooting.
>
> Yes, and the river's, the river, let's see, yes.

He pointed out that he would be able to compare the financial outcomes of several different plans if he could get print outs:

> If you could print the financial accounts off, you could look at them and change maybe one or two things; you could look at the originals there and just see what it's changed on the screen.

Tim speculated as to possible ways of increasing his returns:

> Maybe if I had some winter rape, oil seed rape in there that would have brought a bit more in.
>
> You can do that by going into the office Plan, and changing (it) there, couldn't you?

Listening to the interest groups

Having compared the financial outcomes of the plan, he went to the television to get the feedback from the interest groups. The first person he listened to was the Nature Conservancy Council's representative. His reaction was that Tim's plan had made some improvements, but it was necessary to look at the plan again. Tim's reply was:

> From what he said I could have done a bit better for it. ... . He's fairly happy.

Then Tim thought it would be useful to listen to the rest of the interest group representatives:

> We'll go through all of them, just see what they say then.

The Countryside Commission representative commented that the plan was fairly reasonable, but also suggested that Tim might look at the plan again. Tim thought that both the interest groups have similar opinions about his plan:

> He said very much the same thing, didn't he?

At this point he chose to read further information on the comment.

The National Farmer's Union representative's comment was that the plan was reasonable and the balance sheet was quite satisfactory:

> That's all right then isn't it?

The representative of the local community was not happy about the plan because there would be no more jobs or houses in the village and wanted him to look again. Tim did not strongly object this feedback, but did not want to change any actions to make his plan better for the locals:

> Hah! ha! I have upset the locals. .... You'd have a job to please everybody. ... And still make the financial success of the farm, wouldn't you?

However, he tried to think ways of satisfying the unhappy interest groups:

> I suppose if I change the plan to employ another person or something that would please the locals, would it?

Tim thought that the program had allowed him to experiment with different farm management decisions and to see their implications:

> Yes. It is quite good to learn to, you know fiddle around with and just see what bears actions, you have on the balance sheet.

Tim's second learning session lasted only one hour. Within this time he prepared one plan and received feedback for it. Although Tim did not bother to change his plan, the feedback enabled him to reflect briefly on the actions he took. He was able to speculate how to modify them.

Steven

<u>*Looking at the financial results*</u>

Steven started to compare the new figures with the corresponding figures of the previous plan. (1.38.30):

> Gross margins gone up from 190,000 to 260,000. ... it was 197,000 before, so it is gone up from 197,367 to 267,647, so it is gone up 70,000 (laughter! happy!)
>
> Net worth is up a bit more you see
>
> Doesn't look too bad altogether, is it?
>
> That's quite interesting.... I got a bank balance of 350,000. Previous bank balance was 4,000

He was happy that his plan resulted in a huge financial success. He tried to understand how the crops and the dairy contributed to the large gross margins he had achieved. Then he wanted to look at the balance sheet for the farm.

> Loan (bank loan) has gone down. ... (showing and comparing the opening and closing figures) see ... all the figures quite nice apart from the livestock closing, the dairy cattle.
>
> Closing is there, two and a half, gone up a bit isn't it, net worth has gone up as well.

He was happy about the financial results. He then looked at the estate finances. In the beginning it was a bit difficult for him to understand the reasons for the changes in valuation of different enterprises and buildings. However, by going back to his plan and looking at the changes he made, he was able to figure out the reasons to some extent.

> Oh that is because I am doing work to the station (disused railway station), that is why that is costing that much.
>
> ... shooting is bringing in that much... . ... and the river. yes.

Listening to the interest groups

Having looked at the extremely good financial results Steven anticipated that the interest groups would not be very happy about his plans:

> God knows what they are going to say there .., they won't be very enthusiastic (laughter)

First he listened to the Parish Council's representative who did not like the plan. He could not accept the feedback given:

> That's a load of rubbish!

He explained why he thought that the feedback was incorrect:

> See I have done the workshop units, I have rented two houses, I can't see how on earth anything ... .

Steven thought that he had taken a number of actions in his plan that would have pleased the Parish Council. For instance, he had converted a barn into a workshop that would have created job opportunities for the village. Also he had rented out two houses on the farm. So he thought the Parish Council's was an unfair comment. Because he could not understand the reasoning given in the feedback, he went on to read a further textual explanation for the feedback. However, this reading also did not help him clarify the Parish Council's opinion.

The next interest group he listened to was the Wildlife Advisor who commented that it was sorry to see that Steven was 'not good at protecting the wildlife'. In this occasion he accepted the feedback because he knew the environmental implications of his plan:

> I thought that is what was going to happen

He was able to understand the reason for the feedback, and accepted it. Afterwards he wanted to read more information for the feedback. While reading the explanation he indicated areas where he could make changes to his plan according to the feedback:

> I could change to that (pointing to the text on the screen) 'cut hedges two yearly rather than yearly', no problem, but in group 4 hedge I have left being not cut at all, as far as that's concerned, I have rotated it, I can't really do more than that, (reading) planted the trees, set aside ... turned out to be a complete disaster the first two years, the wild life ... .
>
> go back to the plan and alter that to two years, that's all I can do.

Reading the textual explanation helped him decide what kinds of actions to take in order to incorporate some conservation-related measures into his plan:

> I'll do the hedges

Changing the plan again – the second plan

When in the plan section he went to the hedges and woodlands groups 1 and changed the action to a more environmentally friendly one - cutting hedges two-yearly instead of yearly. Then he thought he would do the same in the other hedges and woodlands:

> I'll go through them all, I suppose.

It appeared that he had taken the suggestion given by the textual explanation followed by the comment by the Wildlife Advisor. However, when he looked at what actions he had already carried out he realised that he was already managing them in an environmentally friendly way, contrary to what the Wildlife Advisor said. In hedges group 2 he had chosen to 'cut hedges two-yearly':

> I did that you see. ... I did do it

In hedges group 3 also he had done the same:

> It is exactly the same, I have only altered one.

Steven thought he had done what the environment group wanted him to. He could not understand the reason for the negative feedback for his actions. It appeared that Steven relied on only one criterion set by the environmental group. In addition to appropriate management of hedgerows, there are other important factors that determine the wildlife on the farm, for instance the intensity of cultivation. A closer analysis of his cropping plan would reveal that Steven chose to grow the majority of his crops at intensity 1, that is, using high levels of inputs such as agrochemicals. This management practice is detrimental to the wildlife population. This could be a reason for the negative feedback. It was not possible for Steven to understand this situation.

Listening to the interest groups

Having made one change to his plan and submitted it, Steven went to listen to the Wildlife Advisor again. The comment was unchanged – still he was told that the plan was not good from the wildlife point of view. Steven did not want to listen to the feedback anymore; he stopped the video clip halfway saying:

> very boring!

He had tried to follow the suggestions based on the feedback but still got the same feedback. He was annoyed because it seemed impossible for him to understand the exact reason for the feedback.

Later on, Steven listened to both the NFU and the MAFF who were positive about the plan. Altogether he only listened to four out of the twelve interest groups; he did not want to continue to listen to the others:

> I don't see the point of seeing (a) lot more ... go to the walk and see what is done to the ... what species they ... .

It appeared that he was not keen to listen to the views of the people from interest groups. But he gathered evidence for the accusations made by the environmental groups.

Looking at the wildlife

He went to field 47 and looked at the list of plants to see what species had been destroyed. He noticed that there was no drastic damage done:

> Not too bad, just going down all these (plant abundance) higher, it is such a ... can't understand what they say.

Here again he suggested that he could not find evidence to support the Wildlife Advisor's accusations. He continued to look at plant species on this field:

> I have gained two ash trees. I have gained everything, haven't I? Everything has gone up except that one (points to a plant). That is the only one that is missing.
>
> Everything has gone up on that ... .
>
> Surprising, that's were I am going to expand the river bit..., see what happens in the intensive bit.

He then went on to look at the plant species in field 13 followed by field 21. In field 21 he found that a few animal species had been destroyed and he was concerned about the loss:

> I seem to have wiped out all the dormice for some reason there.
>
> ... reduced the roe deer, well that's a serious thing I would have thought.
>
> ... develop the trees in a later date ... .

He had put field 21 into a housing development. He expected the possible disastrous outcomes:

> This is where they are going to say it's all action [his actions] destroyed the [wild life], because I put building houses there ... .

Then he looked at the plant list:

> Yes, wiped out most of them you see, putting it into a housing estate you see ... .

The results were as he expected and he agreed with them. He was able to understand the reasoning for the feedback. However, he emphasised that, except in this particular field, in all these other fields (three he had been looking at) the wildlife had increased, hence he did not agree with the overall feedback:

> All the other three sites I have looked at, everything is increased, I would have thought.

Also Steven indicated that he could not make out how some of the animal species has not increased as a result of the housing estate:

> Then I don't know how they work this out you see, you would have thought it's being into a housing estate probably get more blackbirds, being table feeders and got more robins

> ... (looking at the screen more) rats reduced for some reason (laughter!)
>
> ... (looking at screen) wren being table feeders I would have up.
>
> God knows why pheasants gone up after putting it into a housing estate (laughter) ... .

He expected the program's feedback from the environment groups to be favourable. According to his understanding, the results should have been different. It appeared that he could not interpret the results. He continued to look at three more fields where he had made changes, and concluded that:

> ... very little change. ... I don't think I can do better than that.

Afterwards he went to the Office to listen to the interest groups again.

Listening to the interest groups

He started with the Nature Conservancy Council who commented that the plan would be a complete disaster. Steven just laughed and told me that he could not accept that feedback:

> See when I was going through the Walk and just checking plant and animal species there is very little difference, in several cases it has increased, so I take it with a pinch of salt ... .

In the Walk, Steven observed that there were not many wildlife species that were destroyed as a result of his farm management plan. Also he noticed that there were a few increases in the wildlife. This situation suggested that he was unable to see the logic of the reasoning given for the feedback – according to the evidence he had collected, he formed a different opinion.

Next he got very positive feedback from the Rural Development Council who said that his plan was excellent. Steven was happy about it:

> There we are! (laughter!).
>
> I have done what they wanted, I've done the workshops, I've done the tourist centre, I expected that ... .

He was trying to understand the reasoning for the positive feedback. But he again mentioned that he couldn't understand the negative feedback given by the Nature Conservancy Council:

> I hope I really know why they are (the environmental) really getting excited ..., the greens get really excited, because I haven't done anything..., let lose .... I would make .... (laughter) ... .
>
> I think, I can't understand ... .

The next interest group he listened to was the Countryside Commission who said that his plan could produce some good results but he might want to look at the plan again. At this point Steven wanted to look at more information:

> Let's go to Countryside Commission and try and get more information on that one ... .

He looked at the policy and actions, both are textual explanations that elaborate the verbal feedback. Steven commented while reading these textual explanations:

> It says on paths and nature trails which I am not very keen on, ... (pointing to another line) I have done this, 'picnics, converting the barns', I have done all that, that's why they are vaguely in ..., vaguely got plus from them, isn't it?

He was trying to find out the reasons for the feedback from these explanations. However, from time to time, he showed his disbelief in the unfavourable feedback given by the Wildlife Advisor and the Nature Conservancy Council:

> I can't really see where the objection is, because I can't see where I lost the plants and animals, very few because I found them actually.

He then went on to listen to the view of the Nature Conservancy Council; as the spokesperson started with the phrase 'Oh, dear! you have made a complete disaster!', Steven stopped the videoclip and looked at the textual descriptions for the feedback. While he was reading he commented:

> (laughter!) what do you think of that one?

He thought he had done most of the improvements that were suggested in the textual description:

> ... see I have done, did to the ponds as they have suggested (pointing to the screen); cleaned the southern side of both of them (ponds); ditches, well you have got to clean them otherwise you won't be able to farm in.
>
> ... camping and caravan sites; tourists; (when point to one), a lot more in favour of that ... .

His conclusion was that:

> ...when you win points you lose from the other ... .

The reason for this conclusion was that the description he was reading said that camping and caravan sites and nature trails would have effects on wildlife. Steven had done all of these. So he thought he had got favourable comments from those who advocated such actions while he had got negative comments from those who wanted more wildlife.

The next interest group he listened to was the Enterprise Council representative who was very pleased about the plan. Steven understood the reason for the favourable comment:

> Because I am sure because I am doing tourist (centres) and every thing. ... . I thought that was pretty obvious.

Before listening to the next group, the Ramblers, Steven predicted that they would not be happy because he had not included actions such as nature trails in his plan . The comment by the Ramblers was exactly as he had expected. They were not too happy about the plan and asked Steven to change it again. Steven did not listen to the whole video clip; he stopped it halfway:

> That's what we said, isn't it?

Steven was able to understand the reasoning for the feedback.

Later he wanted to listen to the rest of the interest groups, but still was not happy about the feedback from the Parish Council:

> Just see the Trade Union and local, Parish Council, I have heard they are (the Parish Council) rubbish ... .

The Trade Union representative was happy:

> Plus again!

However the local person was not happy; he wanted Steven to go and change the plan. Steven commented:

> I don't know how they can phrase that, because I have done the workshop and the tourist [centre], I thought that is all jobs for locals, I don't know what they say!

In his plan, Steven took a few actions that were favourable for the local community such as building a workshop and a tourist centre. He thought those actions would bring employment opportunities for the local people. The feedback from the local person was quite different to what he had expected. So Steven could not understand why the local did not like the plan. He then went on to read a textual explanation for this feedback. While he was reading he commented:

> ... yes I have done that, disused railway ...
>
> ... the only one you could have done was barns I am not too keen on that I am, I haven't seen many pictures of the barns you see ...

Steven had already carried out one of the suggestions – to convert disused railway station into a workshop which would benefit the local economy. But he did not want to make the other change. He continued to read the textual explanation:

> ... more tourists [tourist centres], I have done that ...
>
> ... the only thing I haven't done was rent to local people, or turn them into whole .... I am selling, whom am I selling (looking at notes) 'selling to and renting to ...' .
>
> so I have to disagree with that. perhaps I can go back and improve it. well, not many ... .

Steven concluded his learning session at this point:

> I think the majority of them are positive apart from that (Nature Conservancy Council) ... I don't think I have done a lot to harm it.
>
> You are not going to (satisfy) them all, you know you could make them more happy with the ramblers trail and this one (Nature Conservancy Council) would say you are upsetting their wildlife.
>
> As soon as you are putting the paths, which is what they want, this lot (Nature Conservancy Council) would say you are upsetting the natural area by disturbing it, so it's you know.
>
> So I don't think I could do any more.

He understood that it would be difficult to please all the interest groups. However, he still had the idea that he had been unfairly criticised by the environment groups.

Steven's second learning session lasted for nearly three hours, during which time he submitted two plans and received feedback. Sometimes it was not possible to find the reasons for the negative feedback – the program was not able to pinpoint the exact reasons. However, the feedback enabled him to reflect on the possible actions that were responsible for that kind of feedback. It made him go back to the Plan again and alter some actions.

Robert

Having completed the plan, he summarised what he tried to achieve:

> I think there are about two things which I have altered, which isn't quite the same as my original plan, trying to be a bit more green. ... I can't remember (the plan he did during the week), which one was the first, the first one (one of the interest groups), he wasn't impressed and he told me to go away and think about my plan again.
>
> I thought blimey this is how they are all going to talk to me I have done something totally wrong, as I was going down the list it was quite good, until I got to the Parish Council.
>
> ..., the planning chap wasn't sure whether I am going to get it all done.

Listening to the interest groups

Having submitted the plan, Robert went to the television to listen to the opinions of the interest groups. The first one he listened to was the representative of the Nature Conservancy Council. Before listening he explained that the response would not be positive, based on his previous experience:

> I know the first one is not good, but it is getting better, first one is the Nature Conservancy.

The response of the Nature Conservancy Council was that his plan would make some improvements with some increases in the wildlife but suggested he should look at the plan again. He thought that response was slightly better than what he received before:

> ... . It is slightly better than it was the other day. Because he was quite stroppy the other day... (what he said was) 'we think you should go and look at your plan' or something. ... . There is lots of people to please and make money as well.

The next person he listened to was the Countryside Commission who congratulated him on his successful farm management plan.

> ... he was happy before, the first one was the one who wasn't happy, but I seemed to have improved it a little bit.

Next, the representative of the Rural Development Commission was happy about the plan. Then he listened to the District Council representative who opposed the plan because Robert was trying to do too many changes on the farm. Robert explained that if other interest groups were expecting such changes planning permission had to be given:

> I converted the station (disused railway station) to a craft centre and some of the buildings to small businesses, that pleased somebody, that is jobs to

local people, if they want jobs, involving the community they got to give permission.

The next four interest groups he listened to were happy about the plan. Robert was able to understand why they gave such feedback.

When he was about to listen to the Parish Council, he said:

> That is the best one, I like this one, just can't get on with this woman (the representative of the group). I don't know what I have done to upset her!

When he was doing his previous plans he got negative comments from the Parish Council for which he could not find the reasons. So he thought he was going to get the same feedback this time. But to Robert's surprise, the representative congratulated him on the successful plan:

> Blimey! I am amazed at that, I don't know what I had done differently... . I've employed only one student, I am amazed at that! pleasantly surprised, shall we say!

In this situation even though he got a positive comment he was not able to find out the exact reason for it. He had been getting negative comments from the same person for his previous plans, and Robert did not think that he had done anything major to change the opinion.

He expected a negative comment from the local person as well:

> Well this guy was against, but ... .

Instead the local person thanked him for the plan Robert had made because it made the 'village a pleasant place to live'. Robert gave his own opinion on all the feedback he received:

> I don't know how many, there is none really bad... .
>
> ... the District Council think I might not get the planning permission.
>
> ... see you can't get the jobs unless you do the buildings, I'll take it to appeal. I think if you've got the backing of people like Enterprise Consultant and Parish Council, I think you would manage to sort them out you see.
>
> ... and then now Countryside and those two, well they weren't, they were in the middle of the road.

Then he wanted to go and see the financial implications:

> ... see what happens to the overdraft because it has gone up a bit.
>
> ... there is a price to pay.

Looking at the financial results

He tried to understand how the fixed costs changed as a result of his plan. He was concentrating on the bank balance:

> I think it is probably, I have sold land for buildings or something, mmm, (looking at notes) when I started off the bank balance was 4,312. Now it is 172,905 and the farm gross margins was 197,367 and it is now 224,300. so that is gone up a bit... .
>
> ... dairy cows should be the, no that is different... .

> ... when I did this the other day I wonder if it is – maybe I made a mistake when I was putting it in, but there was one small field which I sold for building that what's pleased the Parish Council that sort of gives us the kick in the balance [sheet] ... .
>
> ... because the net worth has gone up .... that is a huge rise... .

He was interpreting the results and trying to find reasons for the financial outcomes. He was able to understand how the money had been spent for different enterprises when he was looking at estate finances:

> See I have spent money on the stations, buildings (list of the expenditure on the screen) footpaths, Kingston Brake, ponds, ditches, hedges, so we have got miscellaneous there, that must be selling the bit for buildings.

A further analysis was possible when he was looking at estate finances:

> ... yes, the profit is down a, not it is not, before when I did was like 36 (thousand) I think ... .
>
> But when I did it before I must have made a mistake entering that little field to build or something... .

After this reflection he thought he could make few more changes to the plan:

> I could go back and change things, seem to got plenty of money to play with now... .

Changing the plan again – the second plan

Within the plan section he looked at a couple of fields to see the current cropping and proceeded without making any changes. He tried to change the cropping on the third field into grass for grazing at intensity 3. The computer did not allow that action. The reason given by the program was that there was insufficient grazing. Having read the reason he thought it was not too easy to make any further changes:

> ... you know, pretty close to the limit from the cropping side of things, if I reduce intensity it doesn't like it.

The action he tried was an environmentally friendly one which required first making a few other changes in other fields. So he decided to leave the cropping side untouched. He understood the feedback given by the program and acted accordingly.

> Yes if you say if it is more extensive it is more environmentally friendly from wild life, you are not pushing the land so hard, you are reducing profits as well... .

He thought he could do a few changes that would increase the environmental benefits:

> ... so what I can do is may be do few adjustments to like scrub land and footpaths and that is about it really.

First he put scrub 1 down to be managed. Then he tried to do the same with scrub 2, but the program did not allow it because of the insufficient labour in February. So he left it as it was. He was able to understand the feedback given by the program. The next successful changes were: making a riverside path for the river and riverside, coppice long rotations in other woods, and cutting two-yearly and meadow headlands in hedge group 2.

Afterwards the program bleeped again when he wanted to put the hedges group 3 into cutting two-yearly and meadow headland. The reason was that there was insufficient machinery in March. He did not want to make any changes and left it as it was. The next successful move was to clear the south side of pond 1. Then he submitted the new plan.

Looking at the financial results

> see how much money we've lost to start with!

When he was looking at fixed costs, he realised that he had spent more money on improving the non-cropping activities related to environmental benefit:

> I think I have spent money rather than... .

> Yes my bank balance is down about eleven thousand. You see, this was, farm gross margins is the same because I haven't altered any cropping, but I tried to be more conservation-minded, and to please our friends back in the office.

He was interpreting the results and trying to find out the reasons for the financial outcomes. Afterwards he started to listen to the interest groups.

Listening to the interest groups

> Well we need to go though, because the council chappy .... the... .

The Nature Conservancy Council's comment started with 'Well done!'. This was an improvement to the previous feedback:

> He is happy, improved.

The rest of the groups were favourable except the Rural Development Council representative who was giving the same comment as before – 'plan will produce some changes, but more to be done; just look at the plan again'. Robert tried to find the reason for getting the same feedback:

> ... the answer was the same, because I haven't done any thing that will change... .

But he was not able to understand why the Rural Development Council was not favourable while the Parish Council was in favour of his plans. It appeared that two groups with seemingly similar interests were giving two different opinions:

> I don't quite understand if we go to the Parish Council one she was quite enthusiastic because there were more jobs, but he (Rural Development Council) doesn't seem to, ... I don't know quite ... .

At this point Robert wanted to listen to the Parish Council again to see if the feedback was the same. The Parish Council again congratulated him on the plan. Robert explained why he could not understand the reason for the negative feedback from the Rural Development Council. According to his understanding both the Parish Council and the Rural Development Council have similar interests as far as farming and countryside is concerned:

> ... she says there are more jobs, I think (after listening). Rather contradictory to what the other guy was saying... .

Was this result related to problems in representing complex relationships in the simulation?

Afterwards he listened to all the other interest groups who gave similarly favourable feedback. The only exception was the District Council who considered that Robert was trying to make too many changes. But Robert wanted to stick to his plan because the others wanted such changes in his plan. At this point he stopped the learning session and expressed his opinion about the feedback he received:

> I think that's about it really.
>
> Yes I think it is the Nature Conservancy Council that is happier
>
> ... you are buying the respect or... .
>
> ... is it 12 or, we've got about (counting who were happy and unhappy) one, two, three ..... ten, twelve, they are (locals) happy, they are (Trade Union) happy, they are (Parish Council) happy, he (Wildlife Advisor) is happy, he (Naturalist) is happy, she (Enterprise Consultant) is happy, that is (National Farmers' Union) I can't remember exactly, I think he was pretty happy, MAFF was OK, District Council was (unhappy because) planning permission, and so those two really (District Council and Rural Development Council) that's about 10 out of 12, I don't think I can get it all right.

Robert's second learning session lasted for nearly two hours. During this time, he submitted two plans and received feedback. While looking at financial results and listening to responses from the interest groups, he constantly thought about the reasons for the success or the failure of the plan. On some occasions, it was not possible to find out reasons for the negative feedback. But he reflected on the action he took and made an effort to understand the reasons for the feedback. The feedback prompted Robert to change his actions and select new actions, leading him to submit another plan.

Neil

Looking at the financial results

Having completed the plan and submitted it Neil went on to look at the financial results from all the four farm accounts. He took notes of the figures but was not able to compare them with his original figures:

> I can't tell, I haven't written down the original finances so I can't compare.

He planned to compare the financial figures later on:

> So I've to written them down then after I've completely finished, submit the old, you know, reset it and submit the old plan, so I can see whether I made more or less money or, I know I made a profit.

Then he went on to the television to listen to the interest groups:

> Oh, right, here we go, up the top.

Listening to the interest groups

The Nature Conservancy Council's response was that there might be some improvements but Neil might look at the plan again. The Countryside Commission also gave a similar feedback saying that the plan might be all right but suggested he should have another look. The Rural Development Council's comment was that the plan was excellent. Other favourable comments were from MAFF, the Enterprise Consultant, the Parish Council, Trade Union and the Local.

The District Council said that the plan included a number of changes and it would not be possible to grant permission for all of them. They wanted Neil to make only a few changes. The NFU said that the plan had got real problems as far as its financial aspects were concerned.

The Wildlife Advisor was pleased with his plan. At that point Neil commented that:

> Well he is happy and the Nature Conservative bloke isn't, so I'm not going to worry about the Nature, stuff him!

Neil thought that there were two seemingly similar groups having similar interests giving different comments on the same plan. Neil was not able to understand the reason for that. So he continued to listen to the groups and expressed his feelings about the feedback from interest groups:

> Right the only gang who are unhappy are District Council because they reckon I'm doing too many changes.
>
> ... and the other thing is I'm spending too much money.

He wanted to check the actual financial figures in order to analyse their feedback:

> ... but I can't check the finances, the finances seem to be all right to me, but I can't check them without destroying it all, see and going back to the original plan, can I?
>
> I don't know, unfortunately I didn't write it down, I thought I might have written some of it down, but I didn't write down what the margins were and what the net worth increased by and all the rest of it.

At this point he wanted to go to the plan again and make a change according to the feedback.

Changing the plan again – the second plan

In the Plan section he made one change to his plan. He cancelled converting a farm building into workshops. This was in response to the feedback received from the District Council who commented that Neil was doing too many changes. Having done that he came back to see the response from the interest groups.

Listening to the interest groups

After making the change he went to the office to listen to the interest groups. The District Council said they could not grant permission because there were too many changes in his plan. Neil's comment was that:

> That's tough because I've only got one left to do, so I'm ignoring him.
>
> I had two changes, one to the farm building and one to the disused railway, and so I've dropped one of them and it's still not very happy so I've got one left, so I shall leave it.

It appears that Neil was frustrated because of the feedback he got for his plan. According to his understanding he has got only one building construction and still he could not get planning permission. He thought the feedback was unreasonable. Also he thought he could get those who were in favour of his plan to support his application, as in real life:

> ... hope the Parish Council vote in my favour and persuade them to (get the permission. Also) the locals to ... .

Then he went on to listen to the National Farmers' Union to see if the feedback was favourable. Still the National Farmers' Union's representative believed that Neil's plan had got some real problems and he ought to look at it again. Neil wanted to restart the program in order to get the original financial figures in order to analyse the financial success for himself.

Looking at the financial results

After restarting the program he studied the financial figures. According to his understanding he had not made a huge loss, and he did not want to change the plan:

> ... well I'm not going to do it, I'm not going to do any more, because the changes I've made actually are making slightly less money, profit of 34,000 instead of 38,000. OK, compare see... .

At this point he decided to give up. He found out that he was making a profit of £34,000 where as the original plan was making a profit of £38,000. The difference was only £4,000:

> Four thousand profit difference, the net worth though difference, is one thousand, that's because by converting the railway it increased, the valuation of the property increased.

He continued to analyse the figures and came up with the conclusion that there was an error in the program:

> See I think it is one my great thought that there must be a fault in it... .
>
> ... the reason I think there is a fault is what I did was it told me how many hectares there were of wheat, OK, which was all that (showing the figure), OK, and so then I knew how many hectares of grass there were left, I know, I knew how many stock there were, from that figure on there, go back to...

Based on the figures given in the program about the extent of the farm under wheat he was able to calculate the extent under grass. The program also gave information on the size of the livestock. Based on this information he was able to calculate the basic conditions to fulfil, such as the stocking rate – the extent of land under grass for each animal – before embarking on his farm management decisions. Based on the calculations he did, he made different decisions such as the size of the cattle herd, the extent of grassland and arable crops and the farm labour. All these calculations and assumptions had been done according to his knowledge and experience on farming:

> ... but you need less fixed costs because arable farming is just less intensive in terms of building and labour than cereals ... .
>
> ... when you stop doing something like a beef enterprise you suddenly release lots of money, so all the money that was released I could of used for the conversions anyway ... .

He was going to do his plan predominantly as a dairy farm and in real life he is a dairy farmer. He had carried out some of the actions on his own farm as well:

> We did that very thing here on the farm six years ago but instead of, with the money we raised from stocking the beef we actually bought cows and quota. So I mean we reinvested the capital, do you see.

He predicted a certain amount of financial gain from the changes he made to the livestock industry and other operations. However, when he looked at the finances he was not able to see such a profit margin in the final financial analysis. He could not understand the reason for that situation:

> ... but as I said you worked to the last lot of units, I'm not quite sure where the beef, where they were.
>
> They might have been eating bought in feeds from Italy, that is the only possibility, but I couldn't tell, you can't tell from that, from this... .
>
> but as I say, if I put all those figures in to calculate livestock units it worked out about correct, so it implies that all those beef were actually either grazing or having food which was like conservation, silage, yes, as opposed to having bought in food and being a separate enterprise altogether.
>
> It's not actually possible to tell.

Neil suggested that he was not able to see how the model built into the simulation worked so was not able to see why he did not make the profits he expected:

> ... I'm not quite sure why my business plan hasn't come out slightly better, I thought it would. I thought if you just worked it on the basis of my stocking rate, how many acres was it, that I change (going through the notes again), 47 hectares, the other thing is that, it fair enough ... .
>
> so if I take the wheat gross margin (calculating using the calculator), minus the beef gross margin, multiply that by 40, I'd didn't do that's quite so, well I reckon I should have made an extra 19,000 gross margin, in actual fact I made less.
>
> So that implies that the beef are not, that a proportion of the beef are not having home grown forage, they are having bought in forage ...
>
> ... which if that was the case then, that would reduce the stocking rate on the cows and heifers, yes, which then you say well no, 'cause the heifer gross margin is also only 142, 'cause the margins exactly the same so ... .
>
> ... then you'd say well, perhaps I ought to have less of those, you know, less cows and less heifers and have more arable ... .

The problem was that he could not understand the reason for the financial loss he made. According to his own calculations and assumptions he would have made a profit. Not knowing the underlying assumptions built into the program was a constraint:

> ... but I'm not willing to do that because I don't know what the assumption is ... .
>
> ... then I've increased the number of hectors in winter wheat, yes, to that (figure on the screen), but by another 46 which is about that, but the difference is, see that's 31 and this is 25 so its 6 thousand which is about the difference.
>
> So that's, so really you need a better insight.

At this point Neil stopped the learning session which had lasted about two hours. He prepared two plans and received feedback for them. The negative feedback he received got him to think about the reasons for it, though he was not able to single out the reason why his plan was financially unsuccessful. Neil drew heavily on his real life experience of farming in making his plan and in justifying why it should be successful. The feedback and his own reflection on this feedback prompted him to change his actions and submit another plan.

Duncan

Listening to the interest groups

After submitting the plan Duncan listened to the interest groups. He was getting favourable comments from most of the interest groups. But the Nature Conservancy Council was not so positive. The spokesperson said there might be some improvements but Duncan might look at the plan again. The Countryside Commission also said the plan looked all right but that he should look again. Duncan found this feedback not very acceptable. He mentioned that the Parish Council and the District Council were not happy about his plan during the week when he was doing the session on his own:

> ... it's one and two (the Nature Conservancy Council and Countryside Commission) which I find a bit strange, so do the Parish Council, I can't really believe she believes what she says about it ... .
>
> ... that's the one that, the District Council one that doesn't accept any changes all it seems to me, yes he's the one that doesn't want to give any permission... .

He was going to listen to the District Council and commented on the anticipated feedback:

> Ah, yes this is funny it don't like it, it won't give you planning permission which I think is a little bit strange... .

The District Council said that there were too many changes in his plan so the Council could not grant planning permission. He wanted Duncan to go and make a few changes in his plan. Duncan was not happy because he thought he had got only two changes:

> I think I've only made two though, that require planning permission, he's only going to allow one... .

Duncan did not worry about District Council's comments.

He then listened to the rest of the interest groups who were happy about his plan. Later he came to the Parish Council:

Here's the Parish Council!

The Parish Council said they were not too happy about the plan because there would be fewer jobs and new houses. They wanted Duncan to go and change the plan.

She is not happy.

Duncan had difficulty in interpreting this feedback:

> ... fewer jobs and new houses, I can't work out. I didn't put any new houses in the village.
>
> ... New houses, she is saying, I think she said new houses... .
>
> But I increased the number of houses .... .

At this point Duncan's brother suggested he should listen to the videoclip again. After listening to the section again he looked at a textual explanation for the feedback and commented on the feedback:

> With the new workshop that I built, I would have thought brought more jobs into the village now, I can't, I haven't got rid of any workers.
>
> ... so I'm not quite sure why she thinks there is fewer jobs ... .

To his surprise the next person, the Trade Union representative said that the plan looked all right to him because there would be more job opportunities. But he wanted Duncan to do a bit more:

> I think the Trade Union will tell you that there are more jobs available.

He thought there were anomalies in the feedback. He had made a few comments about it while doing the sessions on his own. For his own plan, he thought:

> Parish Council did not like it because they said there would be fewer job opportunities but Trade Union said there would be more job opportunities.

Duncan thought that the differences of opinions expressed by seemingly similar interest groups were difficult to understand. Also the reasoning given for the feedback was not detailed enough to make sense of it.

Looking at the financial results

He started with the gross margins:

> Well the margin's down very slightly, now I've got rid of the beef and just about made it up on the extra wheat I think... .

He compared his fixed costs with the previous figures:

> That's made a bit more last time actually, I think (looking at notes) ... .

Later he compared his balance sheet with the previous ones:

> Yes I think that's the one before, these are the ones that are the most accurate reflection, the net worth is gone up from what 2.5 million to 2.572 million, I think that's the most accurate thing to take ... .

Having done the financial figures he went to the Walk to see the effect of his plans on the wildlife:

Where did I make drastic changes, the railway stations, railway station where's that, up there?

Looking at the wildlife

He found the disused railway station on the farm and read a description for it. The description said that there would be no significant change in the plant and animals. He found it difficult to accept:

> Why hasn't it changed yet, hang on, (looking at notes) 'cause here's the railway station down here, row of shops, isn't that right, isn't that the disused railway station?

He made sure that he is at the right place and read the description again:

> ... (reading the screen) it will cause no significant change in the plant and animals in the vicinity ... .

It appeared that Duncan found it rather difficult to accept this feedback.

Next he wanted to look at the scrub which he put down to manage. But it was not easy to find the place so instead he wanted to go to another field:

> Actually I have made a field from grass to wheat, which one, this I think.

The fields he looked at were 35, 27, 3, 14, 29, 42, 46 and 37. In field 3 he found that some plant species have been increased:

> Seem to have got a lot of grass in there which I didn't have before, still... .

In another field also he thought he had increased some of the wildlife species:

> And a lot of them have increased as well ... .

Later he wanted to look at the effect of some of the non farming activities:

> I made a path side of river, didn't we, let's have a look at that then ... .

> ... (reading the description for a field) reduced the amount of undisturbed cover for insects and birds, etc. ... .

> ... can't please everybody can you? They wanted paths and reduced the species ... .

He realised that he had reduced some of the wildlife as a result of making a riverside path.

During the second session Duncan did not want to change his plan after receiving feedback for it. As mentioned earlier, he submitted a plan that had been prepared during the practice week. However, during the first session he changed his plans based on the feedback. One instance was when he received feedback from the Nature Conservancy Council. He was told that his plan would not make any changes as far as wild life is concerned. He wanted to make changes in the hedges and headlands:

> What about hedges and headlands then?

It appeared that he was not familiar with different options available to manage hedges and headlands. He wanted to get information on them first. He read information on different ways of managing hedges and headlands such as cut hedges yearly, laying hedges and hedges and meadow woodlands:

> So if I decided I wanted to lay a hedge, lay hedges and meadow woodlands
>
> I'm not quite sure what that means, let's do that and see.
>
> ... how to make a headland, right, OK, it means leave the headlands 10 meters round the outside as a meadow rather than growing crops on... .

After reading this information he carried out a series of actions and got feedback.

However, there was evidence that he too changed his plans several times during the practice week:

> So I changed that, changed it back again, changed it back again, then I changed from, the disused railway station from building workshop to convert to new workshop to see what effect that had, ...

Duncan's second learning session lasted for nearly two hours. While looking at the financial results and listening to the feedback from the interest groups, he tried to relate the feedback to the actions he selected. Duncan found that, on some occasions, it was not possible to find out why some of the interest groups did not like his plan. In order to find out more about the results of his plan, he went to the Walk and investigated whether the wildlife had been destroyed. The feedback prompted Duncan to reflect on his actions.

Simon

Listening to the interest groups

Simon started looking at the feedback for his plan by listening to the interest groups. Since he had been doing the plan during the week he had an idea of what the outcome would be:

> (the NCC) major concerns of the council, some improvements, that is what they said, I wonder if they say the same this time... .

As he expected the Nature Conservancy Council said that there might be some improvements and he might look at the plan again:

> That's the same as I got last time, right.

But on previous occasions he got less positive comments from the same person and he improved upon the feedback:

> I got the first one, I got, out of him was there's been little change, and then I got some improvements, and thought lost.
>
> ... obviously he wasn't happy, he said to submit the plan again, didn't he? but he's obviously slight, you're never going to please the lot, are you?

The Countryside Commission commented on the plan and congratulated him because it was very successful as far as they were concerned:

> Someone is happy at last!

The Rural Development Council said 'excellent' because the plan was right in line with their ideas. Simon was happy about it:

> Excellent, that's the one I want, he was happy last time as well.

Simon was not sure whether he could get favourable feedback from the District Council:

> ... District Council, this may be negative, he is the lazy man.

The District Council said they could not give permission because the plan involved too many changes. He didn't worry too much about this comment.

The comment from the MAFF was positive but he was not sure of the comments of the NFU:

> Yes, Farmers Union, he is a bit ..., my overdraft I think.

As he expected the NFU said the plan seemed to have some problems and that Simon might look again. But Simon thought it was better feedback than the previous one:

> Well I thought it was better than when he started.

The Enterprise Consultant and the Rambler were positive about the plan. But he was not sure of the feedback from the Wildlife Advisor:

> Yes, this is the tricky one, the Wildlife Adviser. I think that might be a bit.

But the Wildlife Advisor's comment was a favourable one, which pleased Simon. His previous comments to Simon had been negative, but Simon was able to guess the reason:

> I guess it might be the intensity (low intensity) that I was, putting the crops in at, I think.
>
> I think last time I did it I probably had them more intense than this time, I probably had a bit of grass more intense than the last time I did it I think.
>
> So yes, that's probably the big difference on that.

The Parish Council's comment was a positive one followed by the Trade Union representative being pleased about the plan as well. Simon could understand the reason for that:

> Yes, I have created a workshop, in the railway (station).

The last feedback was from the Local representative who was also pleased. Simon appeared to be happy about the overall feedback:

> There you go, my plan!

Looking at the financial results

He analysed the financial figures on the computer:

> Total gross, farm gross margin, 197,000. Oh, yes, I'm glad the forage, I was very worried about the forage costs, 'cause that I had a massive great negative, and I thought wrong.
>
> Mine's negative as well, but I was worried that it was, why it was negative.

> Which is obviously the way the account's formulated I guess, Oh, that's all right then. So that the start.

When he looked at the gross margins he thought he had made a successful plan:

> Well I have improved it drastically.
>
> ... (the previous figure was) 197,000. I've improved it by over 10, yes, 10 thousand, no, more than 10 thousand, what's this?
>
> 197, I've got 286, I've increased by nearly hundred thousand, well that's the gross margin admittedly my fixed costs are a lot higher ... .
>
> I was spending a lot of money elsewhere.
>
> (reading the screen) dairy cows... .
>
> That was considerably less, miscellaneous, that's the big difference, miscellaneous revenue ... .
>
> Well there isn't any down here, there 132 thousand for me ... .
>
> Well I've obviously got less cows than he has and everything, but, my wheat is about the same, right ... .
>
> that's alright then ... .
>
> ... happy with that. I probably won't be happy with the fixed costs... .

He was reflecting on and interpreting the feedback.

Then he went on to look at the fixed costs:

> 73 thousand, doubled that as well, my bank balance
>
> Labour is less, machinery's the same, rates and storage are up, interest is down, surprisingly, general overheads is the same ... .
>
> Well interest here he's got 45 thousand and I've got 38 thousand (so less interest)... .
>
> Total fixed costs, slightly up, farm gross margin, miles up, 70 thousand which we discussed, profit and loss, state profit and loss, net worth ... .
>
> I thought the fixed costs would be a lot, because there doesn't appear to be anything in there for, well too much in there for all this building work that I had done... .

Having analysed all the figures he concluded that his financial outcomes were satisfactory. Then he could not understand the reasoning for the unfavourable feedback give by the NFU:

> ... yes that's good, I don't know what the old National Farmers' Union man was complaining about... .

When he was looking at the estate finances he realised that he had been spending a lot of money on building and construction work:

> I don't know what is coming up, I didn't look at this last time.
>
> Buildings, well you could say I've spent a lot of money (laughter) ... .
>
> ... But then it becomes worth 40 thousand spent ... .
>
> ... see I flogged land off for housing, which brought me in 16 thousand ... .
>
> ... didn't do anything to the shooting ... .

> ... spend thousand pound on paths ... .
>
> ... got income from the river ... .
>
> ... and I got 200 thousand pounds coming in from somewhere ... .
>
> ... miscellaneous, that would be from the caravan site, presumably ... .
>
> ... And with all the other little bit and pieces of money I spent on the scrub and ditches and ponds, nice lots of brass ... .

Lastly he looked at the balance sheet for the farm:

> ... land and buildings has increased in value, ...
>
> ... machinery is the same, ...
>
> ... livestock's decreased in value, ...
>
> crops have increased, ...
>
> ... quotas, I don't know why quota, I sold the quota ... .
>
> ... released it, I suppose it's still the value of it, I didn't sell it I just released it, ...
>
> ... I've reduced my borrowings somehow, on the mortgage corporation, bank, which made .... bank overdraft, ...
>
> ... I suppose I must have a positive, that must be a positive figures (pointing to the bank overdraft which has a negative sign), that's the minus one, would it be? ... .
>
> My net worth has increased by three hundred thousand thereabouts ... .

Again he mentioned that he could not understand the reasoning behind the NFU's feedback:

> I didn't know how you have to keep the NFU man happy

Nevertheless he was happy with the plan:

> Oh, well I'm happy with that

Looking at the wildlife

He mentioned that he had looked at the implications of his plans for the wildlife, while doing learning sessions during the week:

> I looked around the caravan site, 'cause I thought that the disturbances there, it wasn't that drastic to be honest

First he went to field 36 and looked at the list of plant species in that area:

> What's decreased then, (reading the list) it's just whatever that is (pointing to the plant that is decreased), (reading the plant name) whatever that is, it's the only one isn't it?
>
> So it's not too disastrous, is it?

However he could not understand why there were few plant species damaged as a result of his plan:

> ... which surprised me.

He had put a camping and a caravanning site in this field. So he thought more wildlife would be damaged as a result. So he could not agree with the feedback.

Then he looked at the animals:

> Lost some gulls, increased the crows, lost a few of that, increase the sparrow.
>
> So the only one that really decreased is the fieldfare and increased a lot of other things, really.

The next place he looked at was the woodlands in field 21:

> So right, we planted a wood, how about looking at that then... .

He looked at the list of the plants:

> ... So they have increased, virtually everything except two, that one, and that one, whatever it is, right ... .

He also looked at the list of animals:

> ... (reading the names from the animals list) blackbird, gull we lost, tit we increased, chaffinch, rook we lost, my goodness, skylark we lost that one unfortunately, hare we kept as the same.

The next place to look at was field 10:

> ... what else major have I done,
>
> ... housing, we'll have a look at field 10 shall we, all those dramatic effects...

He predicted the outcome of his actions – housing development – on wildlife:

> ... there won't be anything will there?

That was exactly the result he saw when he looked at the plants list:

> zero!

Then he looked at the animals list; all animal species were destroyed:

> ... right that's, a bit, there ought to be something there, its still got its sparrow.

He accepted the fact that in that field all the wildlife and animals were destroyed as a result of his action.

Simon's second learning session lasted for more than two hours, during which time he prepared a plan and received feedback for it. While looking at financial figures and listening to feedback he focused on reasons for the positive and negative outcomes. On some occasions, he found it difficult to single out the reasons for the negative feedback. In order to find out how his plan affected the wildlife he went to the Walk section. The feedback provided by the program prompted Simon to reflect on his actions.

William

Looking at the financial results

William looked at the figures and realised that his gross margin had been reduced:

> I have successfully reduced the gross margins by 100,000. That is a good start, isn't it?

He wanted to know more details of the financial loss his plan was making:

> But, one has got to actually put on a broader basis, because I have to go to the balance sheet

He compared the figures in the balance sheet with the previous figures and evaluated the plan:

> ... is that the quota, no that is not. Oh! I haven't sold quota, have I?
>
> I got rid of the cattle (reduction of revenue from livestock)
>
> I've reduced the nett worth ... ,

By looking at figures, he thought about various ways of increasing the revenues:

> I can sell the quota, because I don't need it
>
> I haven't altered the labour, you see

He also received feedback from interest groups:

Listening to the interest groups

William received feedback from spokespersons for five interest groups for his first plan. Most of them did not favour his plan, with two neutral and three were negative. He did not comment on their feedback, but accepted that his plan was not successful:

> It looks like I have got a pretty bad plan going, doesn't it?

Based on the information gathered William went on to make his second plan.

Changing the plan again – the second plan

The first action William took was to change the milk quota, a decision he made after looking at the financial figures. Another change was in the 'Farm workers' category. William received negative feedback from the spokesperson for the Trade Union. William's actions in this category may have been influenced by the feedback he received, as well as the actual labour requirement for the current operations. He altered the number of stock workers and student workers. Other categories William changed were machinery requirements and 'Building grain storage'. He submitted his second plan.

Listening to the interest groups

William listened to the spokesperson for the Trade Union who did not like the plan.

Looking at financial results

William saw that his new plan was financially more successful than the previous one. His gross margins had increased slightly. According to the balance sheet he had reduced his liabilities. Also he had reduced the nett worth, for which he could not understand the reason:

> I've reduced the nett worth, I don't quite know why I've reduced my nett worth.

By looking at figures he realised that he could improve the financial profits by taking actions in a number of fields:

> Oh I see, I have got forage costs there, far too many, I haven't got enough..., I have got a whole lot more fields I haven't done.

Therefore, he went on to prepare his third plan.

Changing the plan again – third plan

William's third plan included actions in 'Livestock operations' and three more categories he did not work on before – 'Houses', 'New farm enterprises' and 'Disused railway station'. He thought he could make a profit by renting and selling houses to locals:

> There are nine houses on the place, aren't there?
>
> I have got three farm workers. haven't I? I don't need all these cottages, I could make quite an inroad into the capital ... .

After submitting his third plan he received feedback for it.

Looking at the financial results

While reading the balance sheet, William understood that, in some respects, his new plan was better than the previous one:

> Well, I have got no liabilities, have I? No overdraft, no liabilities,
>
> ... my nett worth is the same, actually it is a fraction less than ... .

Fixed costs showed that his plan brought in a loss:

> Farming profit is still very low there, in fact it is a loss, isn't it?
>
> Fixed cost of that, and gross margin of that, so I have got a minus figure. So something definitely has got to happen.

Listening to the interest groups

William listened to the spokesperson for the Parish Council, who commented that he had not changed the plan significantly in order to provide jobs and housing. But William realised that this feedback was not as negative as before:

> No, she is not angry this time, there is something

He then listened to the District Council which was not going to give planning permission unless William altered his plan. After receiving feedback, William decided to alter his plan for the fourth time.

Changing the plan again – the fourth plan

William spent more time on his fourth plan than on his second and the third plans. It appeared that he wanted to carry out major changes. He took actions in 'Landuse', changing the cropping in fields he already changed previously. In addition, he took actions in categories related to the environment and the local economy, such as 'Paths', 'River and riverside', 'Managing Kingston Brake', 'Managing other woods', 'Ponds', 'New farm enterprises' and 'Disused railway station'. The negative feedback for his plans from the interest groups may have contributed towards William's decision to take actions in these areas. After submitting his fourth plan he received feedback for it.

Listening to the interest groups

The first feedback was from the Wildlife Advisor, a positive one. The Advisor said that the plan should be beneficial in terms of wildlife. William reflected on the reasons for the positive feedback:

> I have done something to the ponds and things, I think.

The feedback from the spokesperson for the Parish Council had changed completely to a positive one. William was congratulated and told that positive actions had been taken to improve the jobs and housing opportunities in the village. William's reaction was that:

> I made holiday things [holiday flats] in the farmyard, which produced some work.

The spokesperson for the Nature Conservancy Council said that the plan would bring in some improvements in terms of the number and diversity of wildlife. However, William was asked to look at the plan again. William thought that the Nature Conservancy Council and the Wildlife Advisor held conflicting opinions:

> They want me to look at the plan again, but that does seem to be a bit funny, because that conflicts with what the Wildlife Advisor said.

The feedback from the National Farmers' Union was positive. William thought about the reasons:

> Oh, that is a bit better!
>
> ... I intensified all the cropping, and I cut out the barn, and I developed the barns in the centre of the farm for holiday homes, so that gave us a bit more of an income coming in.

The spokesperson for the Ramblers was also positive. William's reaction was that:

> Yes, he agrees. I did a guided tour; they like guided tours

The last feedback William received was from the spokesperson for the Locals, and it was negative. William was accused of not listening to the opinion of the locals and his plan was going to make things worse because there would be fewer jobs and fewer houses. William had difficulty in thinking how to satisfy them:

> Oh, dear! I don't quite see what I am going to with that one. I think selling the cottages, wouldn't it be ...? I would think ... . So we could probably just alter that one ... .

After deciding to take some actions in the 'Houses' category, William went to the Plan section again to make his fifth plan.

Changing the plan again – the fifth plan

In his fifth plan, William concentrated only on houses, a reaction to the feedback from the Local group. He rented four houses on the farm to locals instead of selling them. He rented another house as a holiday cottage. He then submitted the new plan and received feedback.

Receiving feedback from the interest groups

The feedback from the representative for the locals was still negative. He thought that William was not listening to them and the plan is not going to make much difference. He asked William to change the plan. William's response was that:

> You can't get him right

Looking at financial results

Afterwards William went through the farm accounts and tried to understand how much profit he had made. He also went through each item that contributed to a profit or a loss:

> Nett worth is gone up by 150,000
>
> Total liabilities ... it is minus
>
> Bank balance ...., change in networth ...., So I got a profit now again, 284,000 pounds
>
> Where I have gained is only the estate profit, I developed quite a lot,
>
> Disused station
>
> ...woods, I planted them
>
> I have got a big cash flow, grants coming in,
>
> Houses ..., rented ..., rents coming in from the houses, I have taken them out of the sales, but rented them.

In the end he though he made a successful plan.

> So that's not too bad

William's second learning session lasted for more than four hours. He submitted five plans and received feedback for them. While receiving feedback, he reflected on his actions. It was not always possible to find out reasons for the negative feedback. However, the feedback prompted William to change his actions, leading him to submit five plans.

8.2 Conclusions

The final product of farmers' learning sessions was the plans they made. Using these plans as tools to get an insight into the learning outcome of farmers, this chapter carried out a two-fold analysis: the outcome of plans and how it is influenced by the approach to learning, and the farmers' reactions to the feedback and its implications for learning from the program.

First, it analysed the plans made by each farmer. It identified a positive relationship between their plans and their approach to learning from the program. The plans that drew more positive feedback from the interest groups were produced by farmers who made more effort to learn from the program. Those farmers who made less effort produced plans that are either biased towards financial success or got positive feedback from only a few interest groups.

The second aspect that was analysed in this chapter was how farmers reacted to the program's feedback. The feedback provided by the program provoked the farmers and lead them to reflect on their actions. They looked at the results and tried to relate the consequence to the actions they took. They reacted in two different ways to the negative feedback given by the program: on certain occasions they did not accept negative feedback because they disagreed with the reasoning given for it; on other occasions they accepted the negative feedback because they could understand the reasoning given for it. Nevertheless, the negative feedback provoked the users to look at their actions again and find out more about their consequences. Some went on to draw on real life experiences to substantiate their argument that the negative feedback given by the program was unreasonable. Some users changed some of the actions and tried to improve the situation. In most of the cases the users agreed with the positive feedback, because they could relate the positive feedback to relevant actions. However, there were occasions when they could not understand the reason for it. Another feature was that some users found anomalies of feedback. They thought that two interest groups with similar interests gave two different kinds of feedback, which they could not understand why. When they disagreed with the negative feedback, the users seem to show a difficulty to understand how the model built into the program works, hence there was a clash between two models – farmer's and program's.

Chapter 9 will discuss the findings of the Chapters 6, 7, and 8 in the light of relevant theoretical foundations.

Chapter 9
Discussion: the farmers' learning experience

Analysis of data pertaining to the learning style in chapters 6, 7 and 8 gave rise to following findings:

1. evidence of differences in individual farmers' approach to learning from the program (Chapter 6)
2. evidence of a relationship between the individual farmers' approach to learning from the program and making decisions (Chapter 7)
3. evidence of a relationship between the kinds of plans the farmers made and their approach to learning from the program (Chapter 8)
4. the program provided feedback, evoking a range of responses from the users, including reflection on their actions showing signs of deep approach to learning (Chapter 8)

This chapter discusses these findings within relevant theoretical frameworks. The first three findings are related to Marton and Säljö's (1976a and 1976b) investigations into 'deep' and 'surface' approaches to learning. This chapter discusses them under the title 'Relationship between the learning approach and the learning outcome'. The fourth finding has relevance to Laurillard's (1993) 'conversational framework' and Schön's (1987) 'reflective practitioner'. A discussion based on these theoretical frameworks appears under the title 'Special characteristics of the learning experience'.

9.1 Relationship between the learning approach and the learning outcome

9.11 Summary of the findings

The analysis of how the users got information from the program showed a wide variation between users' approaches to getting information. Some users did an in-depth and extensive search whereas others just browsed. Furthermore, the data analysis showed a marked relationship between an individual user's approach to getting information from the program and how he or she made decisions. Those who spent more time and made considerable efforts to obtain information from the program during the first session appeared to go through the Plan in detail and select more actions from more categories and spend more time on the task. Also they showed a better understanding of the information necessary to make those farm management decisions. Those who did an intensive search appeared to understand the behaviour of the program better when they came for the second session, and they faced few objections from the program to their actions. They demonstrated a better rapport with the program. In contrast, those who browsed the program demonstrated the opposite.

The analysis of the feedback they received for their plans showed that there was a relationship between the way they obtained information and the outcome of their plans. Those who did an extensive search received more positive feedback for their plans. They were happy about the outcome, and they faced fewer objections from the program when they were trying to make their farm management decisions. In cases where the program rejected their actions, they were able to understand the circumstances and overcome the problems. In contrast, those who just browsed the information received more negative feedback, faced more problems when making decisions, were not able to understand why the program rejected their actions and finally were not very happy about the outcome. They were not able to find out the reasons for negative outcomes.

There seems to be a similarity between what came out in the data analysis of the Countryside study and investigations into 'deep' and 'surface' approaches to learning. In the Countryside study, those who went deeper into the program were able to do better plans and were happier about them. The opposite was the case with those who just browsed the program. In Marton and Säljö's (1976a and 1976b) experiments, a 'deep approach' led to qualitatively better learning outcomes. A 'surface approach' resulted in the opposite.

9.12 Approaches to learning and learning outcomes

Marton and Säljö identified a close functional relationship between the approach to learning and learning outcomes (1976a and 1976b). According to Ramsden (1988) these investigations, first started in Sweden in early 1970s, made a significant contribution to the understanding of student learning, especially in the context of higher education, and influenced researchers all over the world. These findings have been confirmed several times since publication of their results in 1976 (Marton and Säljö, 1984, 1997). Also the original ideas of this particular experiment have been extended and generalised to student learning on a range of tasks within a range of educational settings (Ramsden, 1988). For instance Morgan, Taylor and Gibbs (1982) studied this phenomenon in the Open University.

These investigations were based on new ideas about knowledge and the learning outcome. Traditionally, knowledge has been described as 'discrete pieces of knowledge passed passively from teacher to learner' (Dahlgren, 1984, p. 24). Also it was believed that 'knowledge can be tested in terms of whether or not the student can reproduce verbatim those elements' (ibid., p. 24). Consequently, the learning outcome is described in quantitative terms as a 'total number of correct answers to a test' (Marton and Säljö, 1976a, p. 4). Marton and Säljö rejected this traditional notion of knowledge, widely used in experimental psychology of learning, because they found evidence of the inadequacy of the traditional method of describing the outcomes of learning. They preferred a description of <u>what</u> the students learn to the description of <u>how much</u> they learn (Dahlgren, 1984; Marton and Säljö, 1976a). Their investigations proved that there were distinctive qualitative differences in the outcomes of learning through different approaches.

It was necessary to employ new research methods, once researchers were committed to look at knowledge as a description of what students learn and outcome as a qualitative continuum (Entwistle, 1976). These new ideas required them to accept the essential uniqueness of each individual student's attempt at learning under uncontrolled conditions. Instead of conducting experiments in controlled conditions, these studies sought to investigate student learning in natural settings. Laurillard (1993) states that this methodology, known as Phenomenography, provides a deep level of description of what is happening to the students when they learn, 'linking the way they think about the content to what they achieve as an outcome' (p. 49). The student is allowed to complete the task undisturbed, and to give a retrospective account of how he or she experienced it, 'much as one might describe an event witnessed' (ibid., p. 50).

In their original research, Marton and Säljö (1976a) selected a sample of university students and asked them to read an article related to reform in higher education in Sweden. The students were told that they would be asked some questions about the article, after they had studied it. Later they were interviewed on the content of the article. The data analysis showed four kinds of answers, qualitatively distinguishable. At one end of the continuum, there were students who understood what the author intended in the article. Those at the other end comprised of those who mentioned residues of unrelated facts. These four categories of answers were hierarchically related, as far as the amount of information on the content of the article was concerned. Marton and Säljö called these four types of answers levels of outcome and asserted that they provide concrete examples of qualitative differences in learning.

After identifying these 'qualitatively different learning outcomes', the researchers were motivated to find out the reasons for these differences, i.e., what did the students do *differently to arrive at qualitatively different learning outcomes?* (Marton and Säljö, 1984). They hypothesised that 'if the outcome of learning differs between individuals, then the very process of learning which leads to different outcomes must also have differed between individuals', a fundamental assumption underlying the line of reasoning pursued in these studies (Marton and Säljö, 1984, p. 37).

Their analysis of students' interviews yielded evidence that the sample of students demonstrated marked individual differences in the type of learning process when confronted with learning materials. Marton and Säljö (1976a) found that two different levels of processing were clearly distinguishable, surface-level and deep-level. These corresponded to different aspects of learning material on which the learner focuses. In the case of surface-level processing the student directs his or her attention towards learning the text itself (the sign), i.e., the student has a reproductive conception of learning; he or she follows a rote-learning strategy. In the case of deep-level processing, on the other hand, the student is directed towards the intentional content of the learning material (what is signified), i.e., he or she is directed towards comprehending what the author wants to say about, for instance, a certain scientific problem or principle. Marton and Säljö summarised the outcome of their research:

> We had been looking for an answer to the question of why the students had arrived at those qualitatively different ways of understanding the text as a whole. What we found was that the students who did not get 'the point' failed to do so simply because they were not looking for it. (Marton and Säljö, 1984, p. 39)

Identification of this functional relationship between the 'depth of processing' and the 'level of outcome' was followed by similar investigations. For instance, Svensson (1977 and 1984) studied the functional relationships between study habits and learning outcomes. In addition, he re-analysed Marton and Säljö's data using a different analytical methodology. Marton and Säljö's method was to analyse students' comments on their own experiences of learning processes, which revealed two levels of processing. Subsequently, process was related to outcome of learning. Svensson, in contrast, concentrated first on students' accounts of what they remembered, and from the characteristics of these outcomes, he drew conclusions about the nature of the processes that accounted for what was remembered. The students' own accounts of how they perceived and experienced that process were used only to complement the analysis of performance data (Marton and Säljö, 1984).

Despite the different analytical method, Svensson too identified the four levels of outcome. Also he identified two different 'cognitive approaches' that students adopted that gave rise to these qualitatively different learning outcomes. He termed them as 'atomistic' and 'holistic approaches', different terms from Marton and Säljö's. The atomistic approach was indicated when students described their activities as involving: focusing on specific comparisons, focusing on the parts of the text in sequence (rather than on the more important parts), memorising details and direct information indicating a lack of orientation towards the message as a whole. In contrast the holistic approach was characterised by students' attempts: to understand the overall meaning of the passage, to search for the author's attention, to relate the message to a wider context and/or to identify the main parts of the author's argument and supporting facts.

Marton and Säljö (1984), comparing their own study and Svensson's, suggested that these differing sets of data yielded by the two research produced two dichotomies: deep/surface and holistic/atomistic. The deep/surface dichotomy emphasises the referential aspects of students' experiences – their search for meaning or not. The holistic/atomistic dichotomy is concerned with the organisational aspects – the ways in which they organised the informational content of the article in their reading. Marton and Säljö suggested that the two aspects are inter-related. In order to understand a text, the learner needs to integrate, to reorganise, to see the passage as a whole. Therefore, these two sets of categories are empirically related.

Entwistle et al (1979, cited by Marton and Säljö, 1984) introduced the term approach to be used in place of 'processing', while retaining Marton's categories of deep and surface. Entwistle et al pointed out that the term 'processing' was too narrow in relation to the differences in learning described. Marton and Säljö (1984) agreed that this change of term was suitable for the shift in thinking about learning. About this time, the understanding of learning was shifting from that of the human information processing model towards the constructivist approach. Consequently, the term 'approach' was accepted.

Later, a third approach was identified by Entwistle and Ramsden (1983). This was called a 'strategic' approach to studying. This approach involves an intention to obtain the highest possible grades, using either deep or surface approaches, or a combination of them.

The original studies, and the majority of the studies that followed, were based on learning from text by students in higher education. In the Countryside study, however, a computer-based medium was the learning material, and farmers were the learners. The data analysis pointed towards a correlation between the farmers' approach to learning and their learning outcomes. However, due to the differences mentioned, it is necessary to scrutinise the defining features of deep and surface approaches to learning to see if they match what was observed in the Countryside study.

9.13 Features of deep and surface approaches to learning

Marton and Säljö (1984) states that the defining features of the approach to learning are based on the students' focus on the learning material: whether they focus on the text itself or on what the text was about (the author's intention, the main point, the conclusions to be drawn). Metaphorically speaking, they equate learners with a surface approach to 'empty vessels' trying to fill themselves with the words on the page. In this effort, students will make a 'blind, spasmodic effort to memorise the text'. They concentrate only on the pages. Ramsden and Entwistle (1981) add that, in taking a surface approach, students tend to memorise discrete facts or ideas, and to be anxiously aware of the need to reproduce information at a later time. They view a particular task in isolation both from the academic subject as a whole and from real life. In contrast, learners who adopt a deep approach go beyond the page, according to Marton and Säljö. They consider themselves as 'creators of knowledge who have to use their capabilities to make critical judgements, logical conclusions and come up with their own ideas' (Marton and Säljö, 1984, p. 40). They try to understand the message by looking for relations within the text or by looking for relations between the text and its underlying structure. Ramsden and Entwistle (1981) add that the deep approach involves an active attempt by the student to understand the author's meaning, to explain the evidence in relation to the conclusion, and to relate the ideas contained in the article to the student's previous knowledge and experience. Ramsden provides a useful summary of the defining features of deep and surface approaches to learning from an academic text, as shown in Table 9.1:

Table 9.1: Defining features of approaches to learning (Ramsden, 1988, p. 19)

Deep approach to learning

Intention to understand

- focus on what is signified (eg. the author's arguments)
- relate and distinguish the new ideas and previous knowledge
- relate concepts to everyday knowledge
- organise and structure content
- internal emphasis: 'a window through which aspects of reality become visible, and more intelligible'

Surface approach to learning

Intention to complete (learning task requirement)

- focus on the 'signs' (the text itself)
- focus on the discrete elements
- memorise information and procedures for assessment
- unreflectively associate concepts and facts
- fail to distinguish principles from evidence, new information from old (learning) task as an external imposition
- external emphasis: demands of assessment, knowledge cut off from everyday reality

The main difference between the two approaches is the intention of the student: whether he or she wants to understand the subject matter or just complete the learning task. This seems to rest happily within the current research. It appears that those farmers who simply browsed the program wanted to complete the task, whereas those who went through the program in much detail wanted to understand it. However, some of the features in Table 9.1 do not seem to fit in with the learning task presented by the program. For instance, whether the learner focused on the sign itself or what is signified has less relevance to the learning task presented by the program. Also features such as 'memorising information and procedure for assessment' and 'focusing on discrete elements' are irrelevant because the learners were not trying to memorise facts during the learning tasks in this study. I discuss these considerations below.

9.14 The need to modify the defining features

The differences between my own study of the farmers' learning and the studies discussed in Section 9.12 mean that it is not possible to apply the theoretical framework directly to my study. These differences lie in measuring the learning outcome, the conception of learning and finally the learning material itself.

In Marton and Säljö's and subsequent studies, the outcome was measured by testing how well students recalled the content of the article they had read. Their objective was to check 'whether the students had understood what the author wanted to say ...'. (Marton and Säljö, 1976a, p. 5). They were interested in '... distinctive qualitative differences in how students grasped or comprehended ideas and principles' (ibid., p. 4). Learning, in this line of research, was conceived as students' ability to go beyond the surface of the material and being able to understand what the author exactly intended in the article. In order to elicit the outcome, each student was asked to read passages within time limits, asked specific questions about the passage and asked to explain what the passage was about.

This conception of learning and the method used to measure the outcome was suited to the kind of learning activity the students engaged in – reading an academic article. It was necessary to ask questions on the content of the article in order to find out the qualitative variation of the learning outcome and consequently to relate the outcome to the approach to learning. In contrast, the learning activity presented by the Countryside program was quite different. The program presented them with information necessary for completing the learning task. Their task was to gather information necessary for making farm management decisions. The outcome was not measured by asking them to talk about what they had come across in the program; rather, they needed to demonstrate their understanding by making a satisfactory farm management plan. The outcome was not measured in terms of whether the farmers were able to remember information or understand the program author's intention. Instead, they were expected to solve the problems based on the program information. The learning outcomes were reflected in their actions, the way they made decisions, the kinds of decisions they made, etc. The outcomes are more complex than the written answers called for in Marton and Säljö's studies.

9.15 Development of the idea of approaches to learning

Since Marton and Säljö first published their results in 1970s, the idea of deep and surface approaches to learning has been applied and studied in a range of educational settings. Consequently, the defining features of these approaches have been refined and elaborated. The main difference between the two approaches to learning has been recognised as the student's intention to understand the subject matter or merely to reproduce it in order to satisfy the task requirement (Entwistle and Entwistle, 1992). Some students try to memorise details while others go beyond the page and try to understand the argument presented in the learning material.

Entwistle and Entwistle (1992) provides a useful summary of defining features of deep and surface approaches to learning (Table 9.2), based on the findings of Marton and Säljö (1984) and Entwistle and Ramsden (1983). In this analysis learning directed towards reproduction and learning depending on transformation are the two main features.

Table 9.2: Defining features of approaches to learning (Entwistle & Entwistle, 1992, p. 2)

Deep approach	**Intention to understand for oneself** Interacting vigorously and critically with the content Relating the ideas to previous knowledge and experience Integrating components through organising principles Relating evidence to conclusions Examining the logic of the argument
Surface approach	**Intention simply to reproduce parts of the content** Accepting ideas and information passively Concentrating only on assessment requirements Not reflecting on purpose or strategies Memorising facts and procedures Failing to distinguish guiding principles or patterns

'Intention to understand', as the main defining feature of the deep approach, fits comfortably with the learning task provided by the program. However, 'the intention simply to reproduce parts of the content' does not really apply to the specific learning experience in the current study. 'An intention to complete the task' would be a better description, as the opposite of 'an intention to understand'. So I shall take the position that the main defining features of approaches to learning, for the current study, would be 'intention to understand', and 'intention to complete the task'. The categories under each approach presented in Table 9.2 are applicable, except 'memorising facts and figures'.

In the case of the intention to understand, the key defining feature of the deep approach, the question arises: understand what? There are two kinds of understanding required by the user in the learning task. Fig. 9.1 is a graphical representation of understanding with regard to the learning task provided by the Countryside Disc.

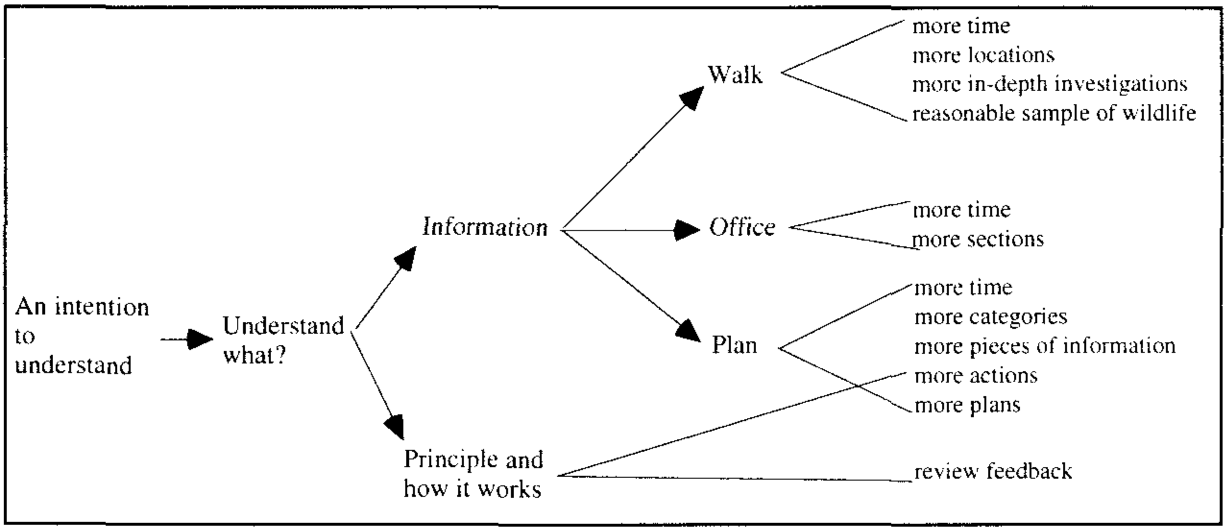

Fig. 9.1: Components of the understanding required by the user

The two kinds of understanding required by the user are:

1 Information: The user needs to understand (or to know) about the farm and its surroundings – the topography, natural vegetation, soil conditions, current cropping plan, the financial situation, people's opinion about how the farm needs to be managed, the consequences of various farm management activities, detailed information on individual fields, etc.

2 The second aspect of understanding is grasping the implications of farm management activities not only for the financial situation but also for the environment and the local economy – the inter-relatedness of all three.

The first kind of understanding comes through 'acquisition', i.e., by reading, listening and viewing the various information displayed. To arrive at this kind of understanding the user needs to go through the Walk, the Office and the Plan. To come to the second kind of understanding, the user needs to make farm management decisions, input them into the program by way of 'submitting plans' and evaluate the result. In this process the user indirectly demonstrates the first kind of understanding, i.e., how much he or she knows about the farm, by using such information in the appropriate manner. The second kind of understanding is rather a higher level, where the user needs not only to acquire information but also synthesise his or her answers.

What kind of activities are necessary to arrive at the first level of understanding? The necessary information is structured in the Walk, the Office and the Plan. To acquire this information, the user needs to go through the various pieces of information within each section. Several indicators 'measure' how much effort each individual has put into reaching this level of understanding. These indicators, shown in Fig. 9.1, on the right, are the 'indicators of learning' used in the data analysis, in Chapter 6.

Time spent on each section was considered as an indicator of the amount of effort the farmers put into getting information from various sections. It could be argued that the quality of time, or how much time was spent on actual studying, is what matters. The pieces of textual information are limited to a single page (except in essays) and the average length of videoclips is only about one minute (except that the introductory video and the videoclip that can be accessed via the VCR are both about five minutes). It is reasonable to expect that, broadly speaking, time reflects the effort to getting information. The other main indicators used to measure the effort put into getting information were the number of locations covered and pieces of information read and viewed. Within the Walk section, the number of locations visited, number of in-depth investigations carried out and a reasonable number of wildlife samples were used as other indicators of getting information. Within the Office section the number of sections covered was used. Within the Plan section the number of categories investigated, the number of pieces of information accessed, actions selected and plans submitted were considered. Even though these elements seemingly represent the physical amount of information, it can be argued that the users need to go through these sections. To get an adequate understanding, they need to access all the above-mentioned information. Based on this fact, the indicators of learning used in the data analysis can be used to 'measure' the depth of approach to learning.

9.16 Discussion based on the approach to learning

This discussion has revealed that the Countryside program provided a learning task that is different from learning from text only. Whether the farmers tried to 'understand' can be examined by how they attempted to make decisions. Data analysis showed that some faced difficulties at this stage because they did not <u>know enough</u> to make informed judgements. Such situations reflect whether they <u>understood</u> or <u>not</u>. Also an examination of whether the set of decisions they made followed a logical sequence or not reveals whether or not the farmers understood the content and principles of the program (a logical sequence is one in which actions are chosen on the basis of reasons derived from the information in the program). Those who made decisions that did not follow a logical sequence could be categorised as not intending to <u>understand</u> but to complete the task. Cases will be discussed individually to detect the existence of 'deep' and 'surface' approaches to learning.

Martyn

The data analysis showed that Martyn studied the program in detail. He was the user who spent the longest time on the learning task (nearly three hours on the first session and five hours on the second session). He ranked high in terms of the number of fields visited and detailed information gathering (level-2 walks). He showed a similar pattern of getting information in the Plan, though he spent less time in the Office. He took notes while getting information. He made notes of his work during the practice week, too. He made use of these while making his farm management decisions. Martyn's approach to learning shows that his intention was not merely 'to complete the task' but to 'understand', hence he adopted a deep approach.

Martyn displayed characteristics of a deep approach to learning during the process of making decisions, too. When the program did not allow some of his actions, he tried to 'relate the ideas to previous knowledge and experience' and critically examine the feedback, instead of 'accepting ideas and information passively'. Martyn selected his actions based on a logical sequence, hence 'integrating components through organising principles'. Selecting actions that are logically related to the other actions showed that he had understood about the farm.

The third step, receiving feedback and evaluating results, too, showed evidence of Martyn's deep approach to learning. Martyn 'related evidence to conclusions' and 'examined the logic of argument' behind the feedback. He did not 'accept ideas and information passively'. He changed his plan based on the feedback, four times during the five hours on the second session. Martyn displayed the characteristics of deep learning.

Tim

According to the data analysis. Tim's pattern of getting information was characterised by browsing. Given the need to understand the present situation of the farm, this approach hardly gave him the 'understanding' necessary to carry out the task successfully. It appeared that his intention was to 'complete' the task. The fact that he did not know some important background information is reflected by his comments when he was not allowed to make certain decisions. It appeared that he did not have the background knowledge in those circumstances. Also the fact that he did fewer actions and did not make any changes in major enterprises reveals that probably he did not bother too much to get the best out of the program. The time he spent on the task was the least compared with the others. It can be concluded that during the getting information stage Tim demonstrated a 'surface' approach.

Some more characteristics of this surface approach could be identified while he was making decisions, and were pointed out in the data analysis. Some of the actions he chose were not based on logical reasoning; he chose actions without any reason to do so. This is clearly 'not reflecting on purpose or strategies' and 'failing to distinguish guiding principle or patterns'; he was just 'concentrating only on assessment requirements', just 'completing the task'. Tim did not have any notes he had taken, or any calculations or step by step processes of how he made decisions. There was no evidence of 'interacting vigorously and critically with the content' or integrating components through organising principles'. All the evidence points towards his adoption of the surface approach.

Tim's behaviour changed as he progressed through the three stages: getting information, making decisions and evaluating the results. As discussed before during the getting information stage, he was demonstrating a surface level approach. During the making decisions stage, too generally he adopted the same approach, although there were indications of some features of the deep level approach. For instance, he reacted when the program did not permit his actions. He tried to 'relate the ideas to his own knowledge and experience' and to 'relate evidence to conclusions'. However, he did not have sufficient knowledge about the program to continue a deep approach. The next stage, evaluating the feedback, brought up a few more instances of a deep approach to learning. For instance, when he received the feedback, he tried to 'relate evidence to conclusions'. It appears that the program's ability to provide feedback on actions led him to demonstrate some of the characteristics of a deep approach to learning. However, his lack of background knowledge of the farm, as a result of a surface approach during the getting information stage, limited Tim's ability to benefit from the deep approach the program tried to evoke.

Steven

Steven's pattern of getting information was characterised by detailed search of all the sections. He had the necessary background information to make his decisions and carry out the learning task. It appeared that his intention was not merely to 'complete the task' but to 'understand' the learning objective presented by the program. During the first session he constantly took notes of the information he was getting. During the practice week too he had taken notes. Also he was in touch with me by phone a couple of times to discuss certain aspects of the program. The extracts shown in the data analysis prove that he did not accept ideas and information passively. Rather he was 'interacting vigorously and critically with the content', and able to 'relate the ideas to previous knowledge and experience'. His comments just before the beginning of the second session show that he was 'integrating components through organising principles'. Steven adopted a deep approach to learning while getting information.

Some more characteristics of his deep approach could be observed during the next stage, making decisions. While making selections, Steven worked through a logical series of steps, demonstrating 'integrating components through organising principles' and 'interacting vigorously and critically with the content', especially when the program did not accept his actions. He did not 'use the information passively' and did not 'concentrate only on assessment requirements'. He did not face major difficulties while making the plan, implying that he had substantial understanding of the farm and how it works. The decision-making stage brought up some more characteristics of a deep approach to learning.

The next stage, where Steven evaluated the feedback, highlighted a deep approach to learning too. While he was getting feedback, especially negative, rather than 'accepting ideas and information passively', he tried to 'relate the evidence to the conclusions'. He 'interacted vigorously and critically with the content'. While looking for evidence for negative feedback, he tried to 'examine the logic of the argument' and 'relate evidence to conclusions'. He 'related the ideas to previous knowledge and experience'. He 'interacted critically and vigorously with the content'; in response to negative feedback he went on to make changes to the plan and look at the feedback several times. He was critical about the criticisms he faced, too. So, there was ample evidence that Steven demonstrated features of deep learning. The particular learning experience provided by the program helped to bring out these features.

Robert

The data analysis showed that Robert's pattern of getting information was characterised by detailed search of all three sections. He was the user who visited the greatest number of fields doing both detailed information gathering and brisk walks. He showed a similar pattern of getting information in the Office and Plan. While he was getting information he took notes. He made notes of his work during the practice week, too. In addition he discussed his work with me by email. While making the decisions he was able to rely on the information he had taken previously, so he did not have to seek more information from the program. These facts provide evidence that his intention was not 'to complete the task' but to 'understand', hence he adopted a deep approach.

During the process of making decisions, too, it was possible to see that Robert was adopting characteristics of a deep approach to learning. There were a few times when the program did not allow his actions. Rather than 'accepting ideas and information passively' he tried to 'relate the ideas to previous knowledge and experience' and critically examined the feedback. After a few attempts, in his first session, he went to study the situation of the farm as a whole. In the second session he did not face major problems, and had a reasonable understanding of the farm. He appeared to make selections based on logical steps – 'integrating components through organising principles'. The actions he chose for his plan were logically related to each other, hence he understood about the farm.

The third step, too, provided evidence of Robert's deep approach to learning. While he was receiving feedback, both negative and positive, he tried to 'relate evidence to conclusions' and 'examine the logic of argument' behind the feedback. He did not 'accept ideas and information passively'. He went on to change his plan after getting the first set of feedback. Robert displayed characteristics of deep learning.

Neil

Neil's method of getting information appeared to be somewhat different from the others. He showed a lot of interest in details of wildlife, thus having less time to go through more locations on the farm. However, he appeared to have done an adequate search during the practice week. During the first session Neil adopted a surface approach but during the practice week he had taken enough information to carry out his learning task.

During the next stage, making decisions, he showed some characteristics of a deep approach. To begin with, he went through a series of logical steps in making decisions, hence 'integrating components through organising principles'. He did not have to look for more information because he had taken information during the practice week. When the program rejected his actions, he tried to overcome the problems by changing his strategy. Also he was able to 'relate the ideas to previous knowledge and experience' and 'relate evidence to conclusions' as the extracts showed. That was a point when he did not agree with the reasoning given by the program for not accepting his action. This shows some aspects of a deep approach to learning.

When Neil came to evaluate his plan on the basis of the feedback given by the program he demonstrated a few more features of a deep approach to learning. For instance, he tried to 'gather evidence for the negative feedback and 'relate evidence to conclusions' and 'examine logic of arguments'. Also he 'related the ideas to previous knowledge and experience'. Although he showed some features of a deep approach while getting feedback, he was unable to continue and make his plan a better one. He failed to understand why the program gave negative feedback. Even if he had the physical information on the farm, he failed to understand how the actions he had chosen interacted with each other and produced the negative results. Perhaps the surface approach he adopted in the early stage of the learning task prevented him from benefiting from the deep approach the program tried to evoke.

Duncan

Data analysis shows that Duncan did a comprehensive search of information within all three sections. He took notes of the information he looked up. There were notes of his home work during the practice week, too. He also contacted me during that week by email in order to clarify certain matters regarding the content of information. While he was making decisions he did not have to look for information. This shows that Duncan had a reasonable understanding of the situation of the farm.

During the process of making decisions, he showed more features of a deep approach. Especially in the first session when the program rejected his action, without 'accepting ideas and information passively', he tried to look at it critically 'relating it to previous knowledge and experience'. Afterwards he went on to gather more information to 'examine the logic of the argument'. During the second session he faced no objections from the program. He came up with a completed plan which he tried out previously. He mentioned that he had tried out several plans during the practice week. It implies that, during the process, he must have demonstrated features of the deep approach.

When he evaluated the feedback, there were a few more examples of a deep approach to learning. For the positive feedback, he tried to 'relate evidence to conclusions'. For negative feedback he did not accept 'ideas passively', rather he attempted to 'examine the logic of the argument', trying to find evidence for it.

<u>Simon</u>

Simon demonstrated a pattern of comprehensive searching of information, spending reasonable amount of time in all three sections of the program. He made efforts to look for as much information as possible and took notes. When he came for the second session, he had notes of his home work during the practice week. All this points towards the fact that Simon did try to 'understand' what the program is about and had not 'accepted ideas and information passively'.

During the stage of making decisions, Simon did not have to go through information; it appeared that he had collected all the information necessary. He was working through a logical series of steps which he had outlined during the practice week by 'integrating components through organising principles'. It appeared that he had reasonable 'understanding' of the farm and how the program works. There were instances when the program rejected his actions, but his comments in these occasions revealed that he 'understood' reasons behind these rejections. All in all, Simon showed characteristics of deep learning.

While evaluating the feedback for his plan, Simon found out that he had produced a successful plan. In response to positive feedback he tried to think of the reasons. This is 'examining the logic of the argument'. While he was examining the financial outcome and the effect of his plan upon the wildlife, he was trying to gather evidence for the kind of feedback he received. This way he tried to 'relate evidence to conclusions'. As the data analysis showed, Simon 'interacted critically and vigorously with the content' especially when trying to find out reasons for negative feedback. He clearly did not 'accept ideas and information passively'. Simon showed characteristics of deep approach to learning.

<u>William</u>

It appeared that William's intention was not merely to 'complete the task' but to 'understand' the learning objective presented by the program. He spent the first hour of his second session studying the Walk and the Office. This may be partly because he did his second session few months after the first session (William was the last to take part in the study and just after the first session, he faced the onset of the busy season). Another reason may be that he wanted to 'understand' rather than merely to 'complete the task'. The data analysis showed that, while getting information, he did not accept ideas and information passively. Instead he 'interacted vigorously and critically with the content'. William displayed characteristics of a deep approach to learning while getting information.

While making selections, William worked through a logical series of steps, demonstrating 'integrating components through organising principles'. When the program did not accept his actions he 'interacted critically with the content'. He did not 'use the information passively' and did not 'concentrate only on assessment requirements'. He did not face major difficulties while making the plan, implying that he had substantial 'understanding' of the farm and how it works.

William showed a deep approach to learning while evaluating the feedback, too. Rather than 'accepting ideas and information passively', he 'related the evidence to the conclusions', especially for the negative feedback. He 'interacted vigorously and critically with the content'. In response to negative feedback he went on to make changes to the plan, submitting five plans in all, and received feedback. There was evidence that William displayed features of deep learning. The learning experience provided by the program helped to bring out these features.

9.17 Summary

Section 1 of this chapter attempted to interpret the individuals' way of learning from the program in terms of 'deep' and 'surface' approaches to learning. It appeared that the approach of the individual learner changed as he or she progressed through the three stages – getting information, making decisions and evaluating plans. During the stage of getting information, there were two users who adopted the surface approach: Tim and Neil. Tim clearly tried to 'complete the task' and browsed information. Neil did not browse but looked for too much detail that was not directly relevant to the learning task. He did not just try to 'complete the task'. Neither did he try to 'understand'. Other users showed clear signs of a deep approach.

When the users came to make decisions, the program offered them opportunities to display some of the features of a deep approach. The feedback rejecting their actions required them to 'interact vigorously and critically with the content'. The third stage, evaluating their plans, produced more features of a deep approach, even among the surface learners.

The nature of the learning experience and the learning task provided by the program required the users to go beyond mere acquisition of information. It required them to synthesise their answers in preparing farm management plans (1) using information presented in the Walk, the Office and the Plan; (2) considering the environment, local economic and financial situation; and (3) using their own knowledge and skills. The process required them to face problems and reflect upon their actions. The whole process required even the most surface learner to execute some deep level approaches, perhaps halfway through the activity. Even the surface learners had to interact with the program because the program required them to do so. It was like the ball being always in their court in a tennis game. The program was taking them on a deep level exploration. The surface learners who just browsed and made decisions in a superficial manner showed some deep level features because the program required them to do so. They could not get away with less. Later in the process, they had to act vigorously and interactively, relate ideas to previous knowledge, etc. Those who did not integrate components through organising principles had to give up, like Neil. Hence it can be concluded that no matter what approach the users adopted at the beginning of the task, the program took them towards a deep approach as they progressed through different stages. This is due to two reasons: one is the special characteristics of the learning experience resulting from the design of the program. The other is the characteristics of the learners themselves. Their practical experience in farming enabled them to take advantage of the learning experience provided by the program.

9.2 Special characteristics of the learning experience

9.21 Summary of the findings

The data analysis showed how the program provided feedback to the users for their actions. The feedback was given at two stages: while making decisions and after submitting the total farm management plan. While making decisions, the program either accepted learners' decisions or rejected them, giving reasons for such rejections. When the program rejected their actions, there were instances when the users disagreed with the program's decisions. However, this situation prompted them to re-think their actions. They made an effort to understand why the program rejected their actions; they went on to read more information, in these particular situations. In some cases the program was successful in providing enough information, and the users changed their decisions. However, there were occasions when the users still held onto their views.

The feedback the users received from the program during the process of 'evaluating the plans' ranged from very negative to very positive. Users reacted differently to this feedback. For negative feedback, there were two reactions: on certain occasions they did not accept negative feedback because they disagreed with the reasoning given for it; on other occasions they accepted the negative feedback because they could understand the reasoning given for it. Nevertheless, the negative feedback provoked the users to examine their actions and find out more about the consequences. Some went on to draw on their own experience to substantiate their argument that the negative feedback given by the program was unreasonable. Some users changed actions and tried to improve the situation. In most cases the users agreed with the positive feedback, because they could relate the positive feedback to relevant actions. When they disagreed with the negative feedback, the users seemed to have difficulty understanding how the model built into the program works.

The activities that occurred between the learner and the program during the learning process point toward important aspects related to learning from computer-based media. The 'conversational framework' developed by Laurillard (1993) may be useful in discussing the results of the current study. Using the 'conversational framework' she developed, Laurillard analyses how different media support the learning process.

9.22 Laurillard's 'conversational framework'

Laurillard advises that her framework does not apply to learning from experience or everyday situations. It is true that farmers acquire a great deal of their knowledge through experiential learning. Also a considerable amount of their learning can be classified as training for which again Laurillard cautioned that her framework would not apply. However, the particular learning experience this program provided to the farmers showed more similarity to the academic learning she described, than to conventional experiential learning.

According to Laurillard, a defining feature of the type of learning is 'what' is being learned. When 'what' is being learned is objects, behaviours and sensations, the type of learning is categorised as experiential learning, because the experience serves as access to that knowledge. When 'what' is being learned is theories, descriptions and view points, the type of knowledge is categorised as academic knowledge. In such situations, the access to knowledge is through some form of representation, such as language and symbols.

In this study, farmers were trying to understand the implications of various farm management decisions for the environment, local economy and financial profitability. The relationship between these factors cannot be studied through direct experience in the real world due to its complexity and the time and expenses involved. In this situation the farmers were similar to students embarking on an academic course. However, there is a difference too, as far as farmers were concerned: they had some understanding and experience of some of the activities they carried out using the program. They had experience in real farming. Also they had observed some phenomena and had some expectations about the nature of the outcome of their actions. This experience changed how the farmers interacted with the program.

The special characteristic of academic knowledge and the consequent difficulties students come across in the learning process motivated Laurillard to develop the 'conversational framework' that illustrates a principled teaching strategy. Academic knowledge is different in the sense that students, more often, do not have the chance to experience the world; rather, they have to rely on others' description of experience of the world. In experiential learning and everyday learning, a student can experience the world directly. Laurillard gives the analogy of learning about dogs and learning about molecules. In the case of learning about dogs, students can carry out a series of activities such as throwing a ball, offering biscuits, or taking them on a walk to gain direct, first hand experience of dog's behaviour. This is experiential learning. In contrast, students cannot experience the behaviour of molecules the same way as they experienced dogs. They have to rely on others' descriptions of molecules, and use things such as ping-pong balls to experience molecules. But it is not the same as direct experience with dogs.

In order to overcome such difficulties, Laurillard suggests five 'mathemagenic activities' that students need to carry out when they learn academic knowledge. Rothkopf (1970, cited by Laurillard, 1994) coined the term 'mathemagenic activity' to describe the activities that give birth to learning. The five mathemagenic activities Laurillard suggests are: 'apprehending the structure of the discourse', 'integrating the sign with the signified', 'acting on the world and on descriptions of the world', 'using feedback' and 'reflecting on goal-action-feedback cycle'. These five activities encompass the essence of the learning process. These are the foundation stones that were used to build the conversational framework that illustrates a principled teaching strategy. Fig. 9.2 shows Laurillard's conversational framework, some aspects of which I discussed earlier, in Chapters 2 and 5.

In the conversational framework, there are 12 actions between the student and the teacher. These actions fall within the framework of the five mathemagenic activities discussed above.

How far is the learning activity presented by the Countryside program related to the conversational framework? Chapter 3 showed that the program consisted of two media components, according to criteria set out by Laurillard. One was the 'multimedia resource' that provides information on the farm; the other was the 'simulation' that allows the user to make inputs in the form of plans and see the results. In this discussion I shall focus on the simulation component of the program because, as will be explained later, simulations provide a learning experience that can be described as interactive. Multimedia resources are useful but their value is limited to providing information (Laurillard, 1993).

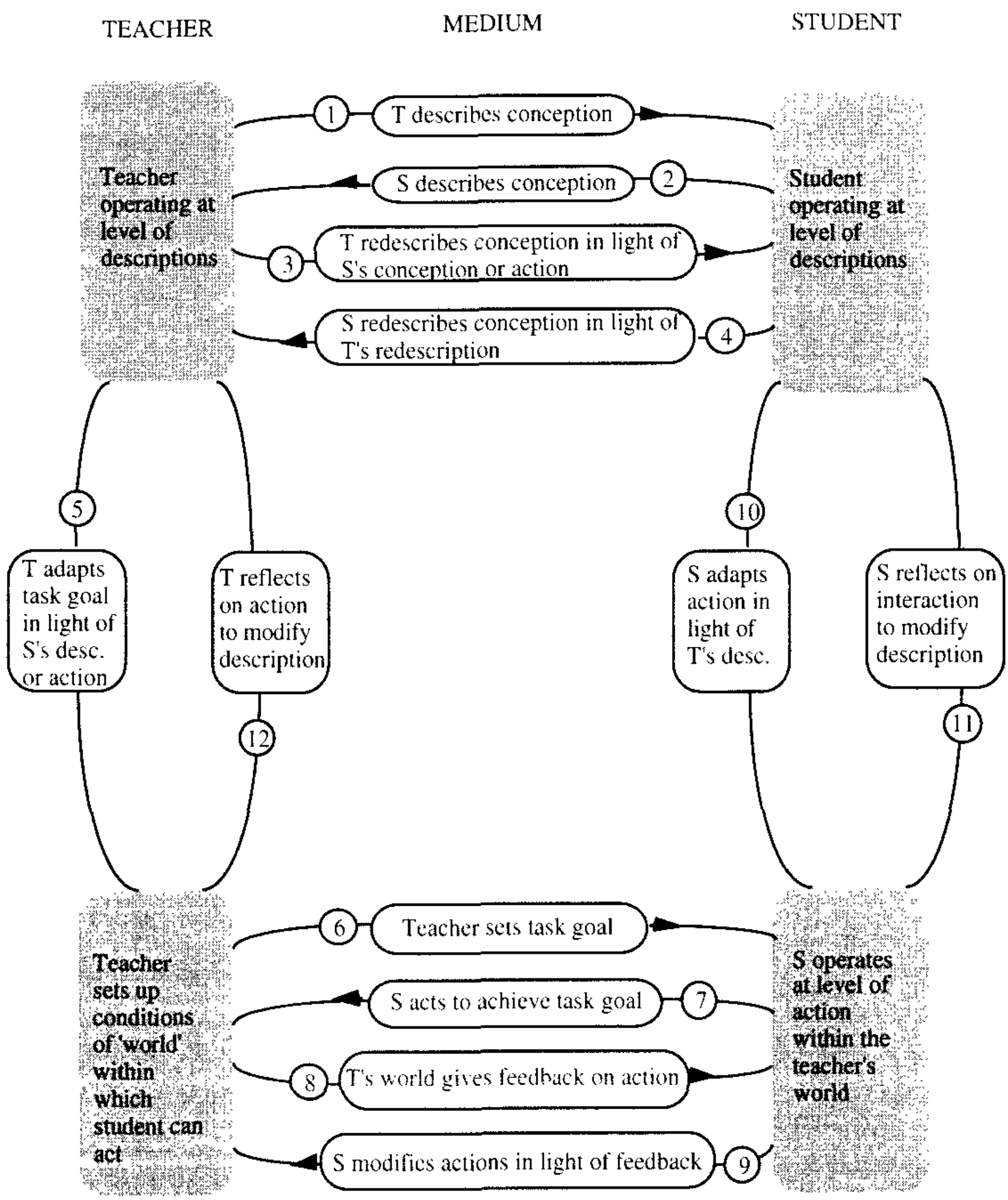

Fig. 9.2: The conversational framework (Laurillard, 1993, p. 103)

First I shall outline how the different teaching functions are supported (or not) by simulations in their basic form, according to Laurillard (1993, pp. 100 & 103).

Discursive function

The characteristics of the discursive function are:

- both teacher's and student's conceptions are accessible to the other and both topic and task goals can be negotiable
- students must be able to act on, generate and receive feedback on descriptions appropriate to the topic goal
- the teacher must be able to reflect on student's actions and descriptions, and adjust his/her own description to be more meaningful to the student

Following are the four activities between the student and the teacher that support the discursive functions:

1 teacher describes conception
2 student describes conception
3 teacher redescribes conception in light of student 's conception or action
4 student redescribes conception in light of teacher's redescription

This aspect of the learning process is required when the teacher and the student are attempting to understand each other's conceptions of the task. Laurillard pointed out that simulations do not support discursive functions because they do not provide opportunities for teacher and/or student to describe their conceptions.

<u>Adaptive function</u>

The main characteristic of the adaptive function is:

- The teacher uses the relationship between his/her own and the student's conception to determine the task goal for the continuing dialogue, in the light of the topic goals and previous interactions.

Following are the two activities between the teacher and the student that support the adaptive function:

5 teacher adapts task goal in light of student's description or action
10 student adapts action in light of teacher's description

This aspect of the learning process allows the teacher and student to adapt their task goal, and follows the previous discursive function. However, the absence of the discursive function means that simulations are not adaptive by the teacher at the task level, as Laurillard points out. In a simulation, teacher cannot make decisions about the level of understanding based on their actions and to suggest new topic focus. The system gives intrinsic feedback on a student's actions but it does not judge the student's actions or make decisions about what they should do next. It also does not comment on them or discuss them.

<u>Interactive function</u>

The characteristics of the interactive (at the level of actions) function are:

- the students can act to achieve the task goal
- they should receive meaningful intrinsic feedback on their actions that relate to the nature of the task goal
- something in the 'world' must change observably as a result of their actions.

Following are the four activities between the student and the teacher that support the interactive function:

6 teacher sets task goal
7 student acts to achieve task goal
8 teacher's world gives feedback on action

9 student modifies actions in light of feedback

Laurillard's analysis is that simulations come very close to being interactive media in the sense that they give intrinsic feedback on students' actions. The actions are inputs to the model, not descriptions. This allows students to have a particular kind of experience. Simulations allow all the four activities in the interactive function.

Reflective

The characteristics of the reflective functions are:

- teacher must support the process by which students link the feedback on their actions to the topic goal, i.e., link experience to descriptions of experience
- the pace of the learning process must be controllable by the student, so that they can take the time needed for reflection when it is appropriate.

Following are the two activities between the student and the teacher that supports reflective function:

11 student reflects on interaction to modify description
12 teacher reflects on action to modify description

According to Laurillard, simulations are not reflective because students cannot reflect on the interaction to modify their descriptions; students' conceptions remain implicit in their actions.

9.23 Discussion based on the conversational framework

According Laurillard's analysis, simulations provide four interactive activities. I shall discuss how these four activities occurred when the farmers used the program to complete the learning task.

Program sets task goal

First, the program set the task goal to the learners. The introductory videoclip summarised the task for the learner; it briefly explained the importance of considering not only the financial but also the environmental and local economic aspects when managing a farm. It pointed out that farmers' management decisions have a range of implications for the environment and the local economy. It then invited the farmers to study the Kingston Hill Farm depicted in the program and asked them to provide a suitable plan for the farm. It provided no opportunity for the learners to discuss the focus of the task; neither did it allow the users to explain their conceptions. The task was handed to the learner. Also the program was not adaptive: it did not adapt to the learner's level of understanding. However, this caused no problems because of the experience they had of farming and the topic that was presented in the program was widely applicable to the range of farmers who used the program.

Learner acts to achieve task goal

The second stage is when the 'student acts to achieve task goal'. In the Countryside Disc, this step consisted of two activities. The first activity for the learner was to get information from the program in order to understand the farm. The second activity was to make decisions and submit plans. The first type of action involved getting information from the multimedia resource (see Section 1). Now I shall focus on learners making decisions and carrying out subsequent actions.

Within the simulation the learner's task was to make appropriate farm management decisions and submit plans. This stage is characterised by 'acting on the world'. Fig. 9.3 shows the mathemagenic activities that are related to the learning experience provided by the program.

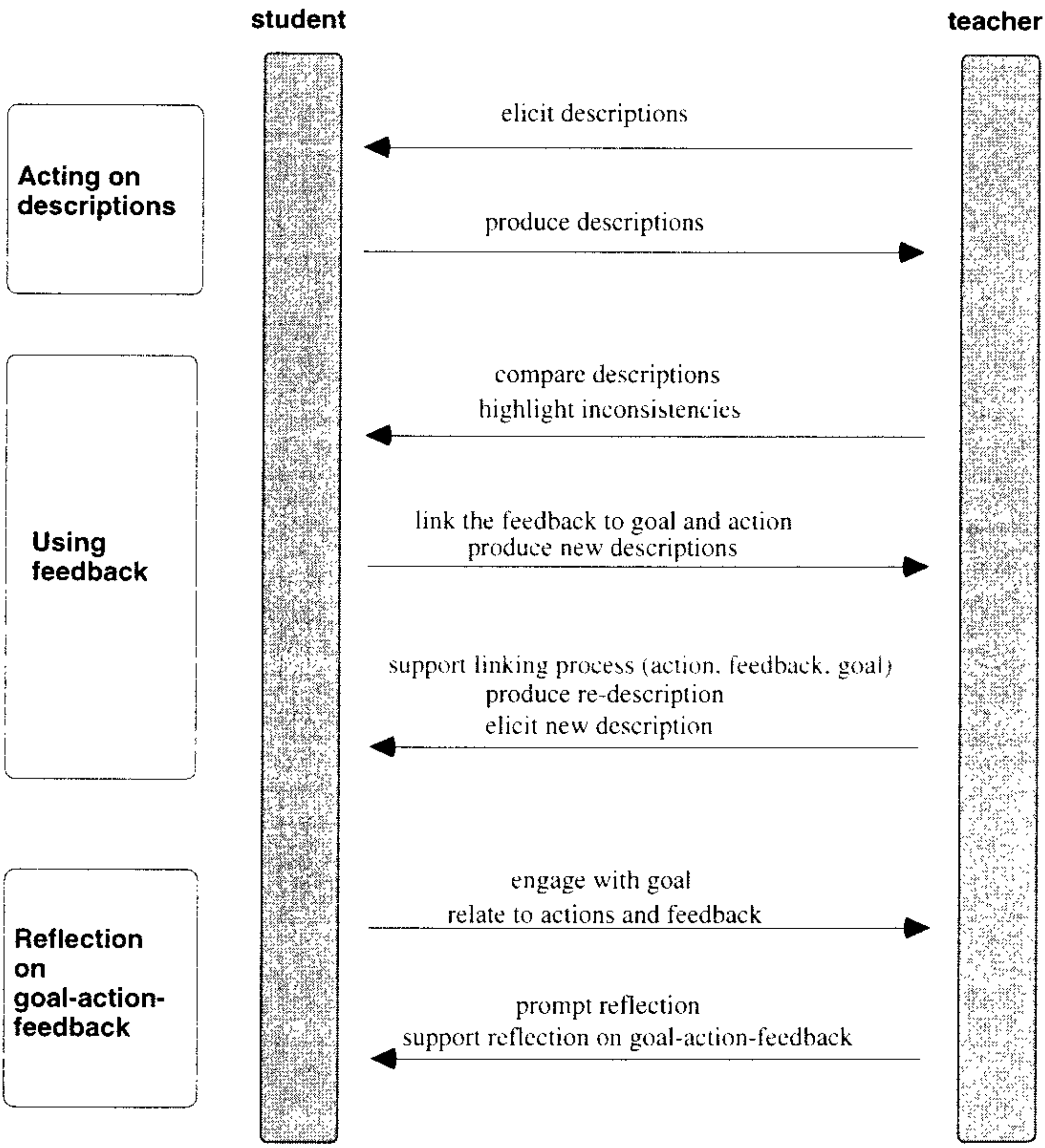

Fig. 9.3: Mathemagenic activities related to the learning experience provided by the program (derived from Laurillard, 1993, p. 86)

Within the activity of 'acting on descriptions', the program 'elicits descriptions' and, in response, the learner 'produces descriptions'. What is the nature of the 'action' that the farmer was engaged in this mathemagenic activity? Laurillard, considering the characteristics of academic learning, mentioned:

> ... acting on the world to learn about concepts is not a straight forward issue. Because academic learning is essentially knowledge through descriptions, it follows that action on that knowledge has to be in the form of further descriptions using language or symbols, or manipulations of language and symbols. The actions are entirely contained in the usage of language or other forms of representation (Laurillard, 1993, p. 61).

Acting on the world is an essential activity that contributes to effective learning. However, due to the second order character of academic learning, learners need to act on 'descriptions of the world' rather than act directly on the world. In experiential learning learners would directly act on the world. As Laurillard explained, this 'acting on the world' is done by manipulating language or symbols.

How did this activity occur in the case of farmers? They did not act on the real world. They did not do actions on a real farm. They carried out actions in a simulated world and these actions were inputs to the model. These actions were not verbal descriptions. In this way the program allowed the learners to 'have a particular kind of experience; it is not operating at the level of descriptions of experience' (p. 132). That is the type of learning that simulations offer, according to Laurillard. However, an important departure from Laurillard's analysis occurred due to farmers' experience with the real world. As the data analysis showed, they tapped into their experience from time to time during the learning process; they attempted to draw on their real world experience directly.

Program gives feedback on actions and learner modifies actions

These are the third and the fourth steps in the interactive function. Laurillard stresses that action without feedback is completely unproductive for a learner, and what is important is not getting the feedback but being able to use it, that is, to 'make the right connection between action and feedback'. This helps the learner to modify the action accordingly, leading to a better learning outcome. 'Using the feedback' is the fourth mathemagenic activity stated by Laurillard.

There are two types of feedback Laurillard referred to: intrinsic and extrinsic. 'Intrinsic' feedback is the feedback given as a natural consequence of the action. The kind of experience a child has when playing with water illustrates this feedback. The child who plays with water experiences the behaviour of water as she or he does actions such as filling, pouring and emptying. The child gets direct feedback that is observably connected to the action.

In contrast, extrinsic feedback occurs as an external comment on actions, such as right or wrong or approval or disapproval. It does not occur within the situation; it is not a necessary consequence of the action. Laurillard points out that extrinsic feedback is the feedback that operates at the level of description of actions, commonly used in teaching and learning. It may or may not be helpful or meaningful. A simple right or wrong is unhelpful feedback because it does not give any information about how to correct the learner's performance. It only tells that correction should or should not be done. It may not be obvious which aspect of the performance is wrong. Laurillard suggested that a more helpful form of extrinsic feedback would give the learner information about how to adapt his or her performance. The key feature of extrinsic feedback is that it is external to the context of action. It refers to feedback that is not 'situated'.

The program provided feedback in two stages. The first stage was while the users were making inputs to the program. In this stage the program continuously evaluated each action on the basis of the current situation of the farm and accepted or rejected the action (users' responses during this stage were analysed in Chapter 7). The second type of feedback was when the program evaluated the whole set of farm management decisions and how it fits with the principles of farm management that the program was looking for (users' responses in this section were analysed under the section 'Evaluating plans').

Feedback while making decisions

During the stage of farmers making inputs to the program, the program continuously evaluated their actions, and either accepted or rejected each action. This is 'comparing description' and 'highlighting inconsistencies'. Laurillard explains this feedback given by simulations: the program can 'inspect the current parameter values input by the student, the state of the system, and the goal, and with all these known to it, ... comment on the validity of the student's input with respect to the state of the system and the task goal' (p. 133). In this case the program comments only with respect to the state of the system, not the task goal. The feedback with respect to the task goal is given after completing all the actions.

Simulations, in their basic form, give intrinsic feedback at the level of actions, but do not provide guidance to the user (Laurillard, 1993). This program behaved differently. In addition to telling the user that the actions he/she was going to take were wrong, the program provided the reasons for the judgement. For instance, when the user wanted to increase the number of livestock, it rejected the action on the ground that there would not be enough labour to manage the extra livestock. This feedback is more helpful than just saying that the user's action was wrong. The additional information may help the user to identify the problem and decide on further actions. However, the program did not comment on the actions; neither did it explicitly guide the user towards the correct actions.

The program's attempt to give feedback on actions is 'comparing descriptions' and 'highlighting inconsistencies', within the mathemagenic activity of 'using feedback' (Fig. 9.3). The user, in response, needs to 'link the goal and actions' and 'produce new descriptions', in order to maintain the mathemagenic activity. The user needs to be able to understand why the program rejects his/her actions. As discussed before, the program provided some information towards this: it mentioned the reason why it could not accept the user's actions. The user was trying to 'link the feedback to goal and actions', and the task for the program was to 'support the linking process' (the link between the action, feedback and goal). The program would be successful if it could provide feedback with information explaining why the action was wrong and how to take the correct action. The program was not capable of the 'linking process', for the reason given above. This situation agrees with Laurillard's assertion that simulations are incapable of this function. However, it is worth examining how users reacted in this situation.

The data analysis showed that a process of reflection occurred at this stage, even though Laurillard mentioned that simulations are not capable of providing the reflective function. In response to the program's feedback the users tried to understand the reasons why their actions were not accepted and made new decisions, i.e., 'produce new descriptions'. Some farmers rejected the reasoning given by the program for not accepting their actions. Some of the reasons for this kind of behaviour by the farmers were discussed under the deep and surface approaches to learning (Section 1 of this chapter). However, there were clear instances when the farmers did not like the way the program 'highlighted inconsistencies'. From what farmers said it is possible to conclude that their experience played a major role in determining their behaviour.

The reflective process the farmers were engaged in is similar to the notion of 'reflection-in-action' suggested by Schön (1987). Schön discusses the importance of reflection in a different context, professional practice. How far can the notion of 'reflection-in-action' be used to discuss the data of the current research?

Reflection-in-action

The kind of knowledge that professionals possess was described by Schön as professional expertise or professional knowledge. The special quality of this knowledge is that it resides in practice, and Schön uses the term 'knowing-in-action' to describe the nature of this knowledge. People reveal this knowledge in their intelligent actions that are 'publicly observable, physical performances' in tasks such as 'riding a bicycle and private operations like instant analysis of a balance sheet'. He described that the 'knowing' in both cases is in the action; the knowledge is revealed by the individual's 'spontaneous, skilful execution of the performance'. The individual is 'unable to make it verbally explicit'. It is this 'unstatable, tacit knowledge' that drives 'knowing-in-action'. When professionals go about their normal work, they can carry out their task 'without having to think' about it. The professional may not be able to explain how he or she carries out the task because knowing is in the action. According to Schön, this knowledge is adequate and it yields intended outcomes.

However, sometimes the situation may 'produce a surprise', either unpleasant or pleasant. This surprise does not fit within the parameters of the tacit knowledge. At this point, according to Schön, the professional begins to think about the situation in a new way. The thinking process that follows he calls 'reflection-in-action'.

Schön highlights three characteristics of 'reflection-in-action'. Firstly, it is a conscious process where both the unexpected event and the knowing-in-action that led up to it are considered carefully. Secondly, it has a critical function: the individual questions the assumptions of knowing-in-action. Schön illustrates this point: 'We think critically about the thinking that got us into this fix or this opportunity; and we may, in the process, restructure strategies of action, understanding of phenomena, or ways of framing problems' (Schön, 1987, p. 28). Finally, reflection-in-action gives rise to on-the-spot experiment. 'We think up and try out new actions intended to explore the newly observed phenomena, test our tentative understanding of them, or affirm the moves we have invented to change things for the better'. The distinguishing feature arising out of the special characteristics of reflection-in-action, according to Schön, is its immediate significance for action.

How does this concept of 'reflection-in-action' relate to the reflective process that the farmers demonstrated while making their decisions? First, a difference can be highlighted in the type of knowledge that drives the farmers' actions. The kind of knowledge the farmers used was not really tacit; it was not an unstatable knowledge. From their comments and actions there was evidence that the farmers selected actions based on their knowledge and experience, which can be stated. It was a deliberate knowledge. It was not 'without having to think about it'.

Despite the difference in the type of knowledge that is involved, there are similarities that make it possible to use 'reflection-in-action' to discuss data of the current research. In the current research too, 'situations produced surprise'. Users' well calculated actions produced surprise. And the reflection that followed was a conscious process. Refection had a critical function and allowed on-the-spot experiment too.

Another applicability arises from the fact that in both cases the reflection-in-action took the learner into a new level of understanding and awareness. In the case of professional knowledge, reflection-in-action raises the awareness of the 'tacit knowledge', which is the fundamental of the 'professional knowledge'. This raising of awareness transforms the 'knowing-in-action' into 'knowledge-in-action' (Eraut, 1994). The implication is that reflection-in-action leads to the development of professional knowledge. In the current research too where the type of knowledge addressed is considered academic, the reflective process helped the learners to come to a new understanding about their knowledge and actions. In this way the 'reflection-in-action' has a similar function, despite the different type of knowledge.

Data analysis showed various situations when the program rejected users' actions. Table 9.3 sets out these situations.

Table 9.3: Situations when the program rejected users' actions

User	Program rejected actions when changing	Users' responses	Reasons
Tim	the number of tractors	**disagree**	**experience**
	the management of scrub area 1	**disagree**	**experience**
Steven	the cropping in field no. 3	agree after a while	complex model complex relationship of information
	the cropping on field no. 25	agree after a while	complex model complex relationship of information
	the cropping on field no. 33	understand agree experimenting	
	the number of stock workers	**disagree**	**experience**
	the number of tractors	understand agree experimenting	
Robert	the cropping in field no. 6	**disagree**	**experience**
	the cropping in field 3	understand agree experimenting	
Neil	the cropping in field 20	understand agreed experimenting	
	the cropping in field no. 33	**disagree**	**experience**
Duncan	the management of hedges	**disagree**	**complexity** **experience**
Simon	the cropping in field no. 3	understand agree experimenting	

The above situations prompted the users to 'stop and think' about their actions – the process Schön termed 'reflection-in-action'. The reactions from the users in response to these problem situations varied considerably. On some occasions users agreed that the actions that they were going to take were not possible. In other situations, users did not agree with the reasoning given by the program for rejecting their actions.

The situations when the users disagreed with the program were:

- Tim trying to reduce the number of tractors and changing the management of scrub area 1
- Steven trying to change the number of stock workers
- Robert trying to change the cropping in field 6
- Neil trying to change cropping in field 33 and
- Duncan trying to change the management of hedges and headlands.

On these occasions the users stopped and thought about their actions, as in 'reflection-in-action'. It was a conscious process, with users looking at information from the program and trying to relate difference pieces of information. They 'thought critically about the thinking that got them into the fix'. However, their experience in farming was different so that they could not accept the reasoning given by the program for rejecting their actions. In some cases this difficulty arose due to the complexity of information they needed to acquire and process before making those decisions.

The situations when the users agreed with the program were when:

- Steven tried to change cropping in fields 3, 25 and 33 and change the number of tractors
- Robert trying to change the change the cropping in field 3
- Neil trying to change cropping in field 20 and
- Simon trying to change cropping in field 3.

On these occasions, too, the users 'stopped and thought about their actions'. They went back to information and tried to find out why the program had rejected their actions. In some cases the complexity of information and difficulty understanding the model depicted in the program posed limitations for them to understand why the program rejected their actions. However, they could find reasons for the rejections and agreed with the program. On these occasions, they tried out on-the-spot experiments using their new actions. Here too the reflection was conscious and critical. As Schön points out, 'reflection-in-action' has an immediate significance for action.

Real life experience played a major role in the reflective process. It provided the basis or the resources for the farmers to reflect on, to draw on. Therefore, learner characteristics are important for the reflective process.

Feedback after submitting plans

The second stage when the program gave feedback was after each farmer had submitted the whole farm management plan. In this instance, the feedback was given with respect to the task goal. The program analysed how far the totality of a user's actions matched the task given in the beginning, and gave relevant feedback.

The feedback was in two formats. One was the display of financial outcomes and changes in wildlife numbers. The other was the comments on the results. Laurillard mentions that simulations, in their basic form show outcomes of inputs in terms of 'numerical values, a diagram, a picture, an animation, or as a description of its new state'. This program also behaved similarly. It showed its new state as changes in figures and interest groups' descriptions of what happened to various components of the farm. In this way, according to Laurillard, simulations are interactive in the sense that they can provide intrinsic feedback on their actions. They show what happened as a result of students actions. Laurillard adds that a simulations does not comment on actions in its basic form. However the design of this program allowed it to comment on whether the outcome was acceptable or not, from the point of view of each individual interest group. Laurillard shows the possibility of building such simulations.

To some extent, the nature of the feedback that the program provided is similar to that of microworlds. According to Laurillard, microworlds offer feedback at the level of description. They can provide a comment on their descriptions of actions, and indicate what kind of change learners have to make. But this program did not go that far: it could not tell the user what kind of actions to make a better plan. It commented only on users' actions: something more than simulations could offer but less than microworlds could offer.

By reflection Laurillard meant an opportunity for the 'student to reflect on interaction to modify description (or actions)' and 'teacher to reflect on action to modify description'. In this process the teacher would help the student to 'link feedback on their actions to the topic goal'. In their canonical forms, simulations are not capable of providing the above functions, according to Laurillard. However, she mentions that it is possible to design a simulation that can help the student reflect on the interaction between the student and the program. Data analysis of the current study showed that the users were engaged in a reflective process while they were getting feedback for their plans.

This reflective process is different from the previously described 'reflection-in-action'. In the previous case the reflection is intertwined with accomplishing the learning task. The reflection in this instance is after the completion of the learning task. Schön terms this kind of reflection as 'reflection-on-action', an activity which occurs in professional practice: 'We may reflect on action, thinking back on what we have done in order to discover how our knowing-in-action may have contributed to an unexpected outcome. We may do so after the fact, in tranquillity ... .' (Schön, 1987, p. 26). Although the type of knowledge being considered in the current study is different, as discussed previously, the activity has an application for the learning task the farmers were engaged in. They were thinking about their actions in tranquillity after completing the task. So I shall use Schön's term 'reflection-on-action' to discuss this phenomenon.

Reflection-on-action

The ways the users reflected upon their actions have been analysed in Chapter 8. How they evaluated their plans showed that receiving feedback contributed to this reflective process. They tried to look at the feedback and relate it to their task and actions. This is the phenomenon discussed by Laurillard as 'reflection on goal-action-feedback cycle', the fifth mathemagenic activity. The learner needs to reflect 'on what the feedback means for the action in relation to the goal to be achieved; on what the goal means for the action to be set up in the light of the feedback on the last action, etc. Reflection is not confined to the goal, but as an aspect of the learning process it must always attend to the goal' (Laurillard, 1993, pp. 64-65).

Users' reflections were prompted at two stages: looking at financial results and listening to the feedback of the interest groups. When they were looking at the financial outcome of their plans, they tried to relate the results to their actions, tried to understand the reasons for the results and studied how far their actions contributed towards their goal. While they were listening to interest groups, too, their comments showed similar patterns of thought.

The feedback is the component that triggered this reflective process. A number of features contributed towards the quality and the depth of the reflection that is illustrated in the data analysis. One feature that helped the reflection was the description that the learners had of their actions. They used their record of the actions they made. Alternatively the program kept a list of all the actions (more than 100 actions). The users could access this list by selecting 'List' on the menu bar. This is similar to what Laurillard indicates as the program's ability to keep the 'execution history' so that students are able to use that information to reflect on the interaction that both program and student have been party to. As she mentioned, this is not the basic form of simulation. Also this facility brings the program closer to the characteristics of microworlds.

According to Laurillard (1993, p. 139), 'the key difference between simulation and microworld is in the way the student interacts with it. The microworld provides a mediating mechanism for acting in its world, namely a programming language. This provides a description of what is happening in that world. Students describe their actions in the form of a set of commends, then run them as one would a program, and the result is either the intended behaviour or something unexpected'. In sophisticated designs of microworlds, the screen can display a symbolic representation of the student's description of the events together with a display of the results. The difference in the learning experience lies in, according to Laurillard:

> ... whether the action exists as a description, and can be 'captured' for inspection, reflection and revision resulting from feedback, as in a microworlds, or whether it remains a fleeting thought captured only as a part of the memory of the action, as in a simulation (Laurillard, 1993, p.141).

In the Countryside program the users' actions were more descriptive than numerical values. They are more like sentences about their actions. Even though the commands or inputs were not the same as programming language, they were more like a natural language, with more than 100 sentences or commands. These commands executed the behaviour of the microworld of the farm. The users were able to 'capture their description of actions for inspection, reflection and revision'. They could change individual actions if they wished, and some users did so, and looked at the resultant feedback.

This special feature helped the learners to reflect upon feedback and relate it to their actions and goals. This reflective process took various turns when the program gave them negative feedback. The data analysis shows that even when they got negative feedback they tried to relate the feedback to their actions and speculate on how to make alternative actions in order to arrive at better plans. This process went on smoothly as long as they were able to make 'a link between the feedback and the actions'. When they could not do that their reactions were different.

In these occasions the users found it hard to accept the feedback, because they could not accept the reasoning given for the feedback. Data analysis showed that they first tried hard to understand why the program gave negative feedback. They consulted different resources such as the farm accounts, increases and decreases of wildlife and various comments from the interest groups, and compared that information with the 'execution history'. When they could not find evidence for negative feedback, or 'make a link between the feedback and actions', they attributed various reasons for it, such as a fault of the program, or the program being more biased towards environmental and local economic considerations.

Laurillard points out that the feedback should be given at the level of descriptions and it should be qualitative than quantitative. This program is successful to some extent: it provided descriptions of what changes were brought about by users' actions and it commented on these actions. These comments included what the interest groups thought about the users' actions. However, some users criticised the program, saying that it did not tell them what exactly was wrong with their plans and what exactly was needed to correct the plan. Like all simulations, the Countryside Disc had its limitations, though it is a complex simulation. It could not give such focused descriptive feedback. As mentioned above, the program evaluates more than 100 actions to give feedback to the user. A positive or negative reaction from the user could be triggered by any number of combinations of actions.

The program's inability to pin point the exact reasons causing negative feedback, and to guide the user towards correct actions, had both negative and positive effects on the learning process. On the negative side, users were frustrated by the feedback. They thought that the program did not give adequate support for learning. However, on the positive side it allowed them to suggest various reasons for the negative feedback and to use available information to test whether their assumptions were correct. In this way they were able to understand more about how the various actions work.

Those who wanted more guidance from the program were effectively requesting access to the program's conception. Laurillard pointed out that providing access to the teacher's conception is a matter of design decision. Simulations are based on a model that remains hidden in the program. It is inaccessible to inspection by students. However, it is possible to give a copy of the underlying model of the simulation to the users, so that they can compare the paper version with the feedback they receive. Laurillard mentions that the point of building the simulation is to represent the complexity of the relationship among the variables. The students need to become familiar with it by investigating the behaviour it models rather than by inspecting its explicit form. Providing both forms of access, the simulation and the paper version, gives the student a better chance of understanding how the model works.

The way the simulation offered feedback had a very positive effect on the learning process, especially the interest groups' comments on their actions. Users pointed out that even though they started their plans with purely financial considerations in mind, the comments from interest groups, especially the negative ones, led them to explore how to balance financial considerations with local economic and conservation aspects. In that sense, the users were engaged in 'mathemagenic activities'. The program 'compared descriptions and highlighted inconsistencies'. Users 'linked the feedback to goal and action' and 'produced new descriptions'. And the program, in response, supported the linking process and produced re-descriptions and elicited new redescriptions.

9.24 Summary

Sections 2 of this chapter attempts to discuss the special characteristics of the learning experience provided by the program. Although the farmers are not the usual candidates of academic learning, the Countryside Disc provided a learning activity with similar characteristics to academic learning. It allowed them to 'act on the world (descriptions of world)', 'use feedback' and 'reflect on goal-feedback-action cycle'.

'Acting on the world' helped the farmers to gain experience on the simulated world. Although farmers can very well act on the real world, they cannot get the same learning experience. In the real world, it is not possible to see the result of their actions immediately. Neither can they get an insight into the complex interrelationships between various inputs and how their actions impact on various aspects of farming. The program used for the study was capable of satisfying this need. In addition, learner characteristics such as their own experience in farming added to their learning experience. From time to time farmers tapped into their own experience while making inputs.

'Using feedback' was the next mathemagenic activity. The program provided feedback while the farmers were making decisions and after they had submitted all their actions. While they were selecting actions, on some occasions the program showed that some of the actions they were going to take were wrong, and unacceptable. This is a basic function of simulations. However, this program was able to give reasons why the actions were unacceptable. This additional feature was helpful for farmers to identify the problem and decide on further actions. Ideally the feedback should be more than that; it should include more information, comments and guidance as to how to correct actions, which this program was not able to provide. However, the characteristic the learners possessed, their own experience of farming, was helpful for them to reflect on their actions. This reflective process was similar to 'reflection-in-action' mentioned by Schön. It was a conscious process which had a critical function and an immediate significance for action.

‘Reflecting on goal-feedback-action cycle’ was the next mathemagenic activity. In addition to the feedback while making actions, the feedback after submitting their plans evoked this reflection. This feedback was richer: it showed the new state of affairs after submitting plans as both changes in figures and descriptions of interest groups. This feedback is a function of simulations. More importantly, the feedback was enriched by the comments of interest groups on users inputs, a specific design feature of the program. This feedback evoked reflection from users on their actions and the goal. This reflective process was similar to ‘reflection-on-action’ mentioned by Schön. Their own experience of farming helped the farmers to engage in reflection.

9.3 Conclusions

This chapter discussed the findings of data pertaining to the learning style within three theoretical frameworks: Marton and Säljö’s ‘deep’ and ‘surface’ approaches to learning, Laurillard’s ‘conversational framework’ and Schön’s ‘reflective practitioner’.

Some learners showed a surface approach whereas others showed a deep approach to learning from the program. There was evidence that the individual users’ approach to learning from the program was positively correlated to the way they made decisions and the final learning outcome. These findings are comparable with Marton and Säljö’s findings regarding approaches to learning and learning outcomes.

However, an important departure was observed: an individual learner’s approach changed as he or she progressed through the three stages of the learning process provided by the program – getting information, making decisions and evaluating results. During getting information there were users who could be clearly identified as surface learners and deep learners. But when they came to make decisions and evaluate plans, the nature of the learning experience and the learning task provided by the program required them to exert some features of deep approach. It required them to go beyond just acquiring information. The whole process required even the most surface learner to execute some deep level approaches perhaps halfway through the activity. There were two reasons for this: one is the special character of the learning experience resulting from the design of the program. The other is the characteristics of the learners themselves. Their practical experience in farming enabled them to take advantage of the learning experience provided by the program.

The special learning experience provided by the program enabled the farmers to: ‘act on the world (descriptions of world)’, ‘use feedback’ and ‘reflect on goal-feedback-action cycle’, three mathemagenic activities identified by Laurillard.

‘Acting on the world’ helped farmers to gain experience in a simulated world. Though they have access to the real world of farming, the simulated world provided learning opportunities that the real world cannot offer. The most significant outcome of acting on the simulated world was that they received a variety of immediate feedback: one, telling them, with reasons, whether they are right or wrong in taking some actions; two, displaying the outcome of their actions; and three, commenting on their actions and suggesting for improvements. Though the program had its limitations, the feedback prompted the farmers to 'reflect on goal-feedback-action cycle', fulfilling an important mathemagenic activity. These reflections were related to Schön's 'reflection-in-action' and 'reflection-on-action'. The farmers' own experience of real farming contributed heavily to this reflective process.

This particular learning experience did not occur smoothly. Learners faced a range of problems, classified broadly as navigational problems, while engaged in the learning task. There were two users who were not able to complete the task at all, due to navigational and other problems. Chapter 10 will analyse these navigational problems and discuss the implications for learning from computer-based media.

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Chapter 10
Navigational problems

This chapter describes and discuses the navigational problems farmers faced while learning from the Countryside Disc. First, it discusses the reasons for navigational problems in computer-based media. Second, it categorises and analyses the navigational problems the farmers faced. Third, it discusses the implications of these navigational problems for farmers' learning from the Countryside Disc. Fourth, it discusses the solutions suggested in the literature, and finally it suggests some solutions to overcome the navigational problems that the Countryside Disc posed.

10.1 Why navigational problems?

According to Nielsen (1990), navigation is the active process the learner must engage in while learning from a hyperdocument. The term 'navigation' is not normally applied to the process of reading books and magazines and viewing films, because of the linear nature of such experience (Gay and Mazur, 1991). We normally read a book and view a movie, starting at the beginning, continuing to the end, in the sequence imposed by the design. In contrast, hyperdocuments are non-linear – they have neither beginning nor end. Due to this non-linear structure, the learner of a hyperdocument constantly asks himself or herself: 'Where am I? Where do I want to go? and How do I get from here to there?' (Robertson et al, 1981, cited by Van Dyke Parunak, 1991, p. 300). These navigational problems are particularly important because they are at least partly responsible for the success or failure of the learning experience.

In order to understand the reasons for the occurrence of navigational problems, we need to examine the specific learning experience provided by computer-based media. Laurillard (1987) proposed two models of learning based on 'what' is being learned: the 'communicative' and 'didactic' models. In the didactic model, the learner deals with something that is 'definitely known' in a subject. In contrast, in the communicative model what is being learned is not a given body of facts and theories, but a 'negotiable commodity between the learner and the teacher' (Laurillard, 1987, p. 3). The major difference in the 'communicative' model is that the knowledge is not considered to be something that can be given from one person to another. Rather, the learner constructs his or her own descriptions of the world. The teacher's (or the program's) job is to facilitate the development by students of their own perspective on the subject.

The learning experience provided by the Countryside program is similar to the 'communicative' model suggested by Laurillard. The program not only provides information to the learners; the learners have the task of creating their own understanding.

A defining feature of the 'communicative' learning experience provided by hypertext-based media is that it gives greater control to the learner (Kinzie, 1990; Kinzie and Sullivan, 1989; Friend and Cole, 1990; Murphy and Davidson, 1991; Laurillard, 1984; Plowman, 1988). With greater learner control, hypermedia becomes an enabling technology rather than a directive one (Marchionini, 1990). Being able to browse information according to associations in the learners' own cognitive structures enables them to construct their own knowledge. 'The freedom to browse, navigate and take part in a journey or voyage of discovery at will, is the most distinguishing feature of hypertext' (McAleese, 1989, p.7).

Laurillard (1987) discussed three aspects of learner control (a) control over learning strategy, i.e., the learner is making decisions about the sequencing of content and activities (b) control over the manipulation of learning content, i.e., how the learner is experiencing the domain being learned – whether or not this is by direct manipulation of it and (c) control over the description of content, i.e., whether the student constructs their own perspective of the subject. Greater learner control is necessary for a successful 'communicative' model of learning experience and in fact hypermedia are very good at providing it.

However, this freedom has its costs: Learner control requires responsibility and decision making (Marchionini, 1990). Learner control means that learners are required to demonstrate appropriate information handling skills, and they may not always have these (Laurillard, 1995). Consequently learners face a range of difficulties and may fail to meet the objectives. A higher degree of learner control is one of the two major sources of navigational problems (Marchionini, 1990; McAleese, 1989). The other source of navigational problems is related to design. Resulting from this there are two main problems with hypermedia: disorientation and distraction (Conklin, 1987; Mayes et al, 1990; Allinson and Hammond, 1989; Edwards and Hardman, 1989).

Disorientation is the problem of 'getting lost in the hyperspace', of not being sure where you are in relation to other parts of the network. Users may experience difficulty finding specific information, or may ramble through the knowledge base in an unmotivated and inefficient fashion, unable to forge the linkages between the individual pieces of information and to discover the underlying concepts (Allison and Hammond, 1989). This tendency may increase as the size and the complexity of the hypertext increases. At the same time, the large number of alternative choices available in the program causes distraction. Learners have difficulty in deciding which link to follow and which link to avoid.

10.2 Analysis of navigational problems

In the Countryside study, farmers faced a range of navigational problems once they got into the program. The beginning of the program was fairly simple; I asked the users to select the 'Simulation' from the main menu (see Fig. 10.1). The program starts with a short videoclip in which the presenter explains the program's structure and learning objective and tells learners how to access help when necessary.

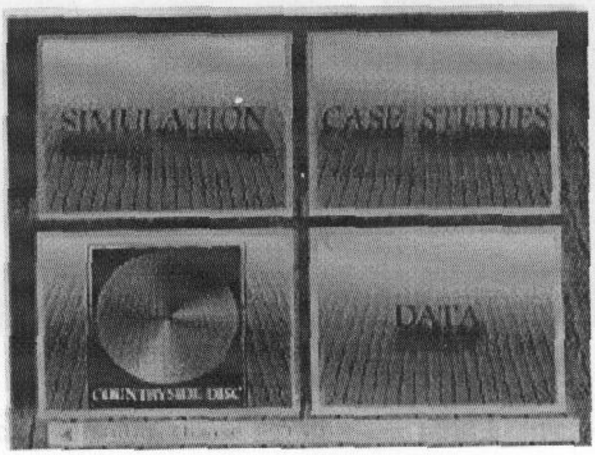

Fig. 10.1: Main menu

The introduction ends with a frame showing the bottom menu bar with four icons: 'Info', 'Walk', 'Office' and 'Plan'. The presenter asks the user to select either the 'Walk', the 'Office' or the 'Plan' from the menu bar. At the end of the videoclip, the user would normally select one of these three icons. In this study, I advised them to select either the 'Walk' or the 'Office' before selecting the 'Plan'. Though the users found no difficulty selecting one of these clickable words they faced difficulties whilst they were in the Office and the Walk. These problems fall into five main categories:

- Do not know how to progress
- Missing important navigational tools
- Not using appropriate navigational tool

- Missing vital information
- Misinterpreting information

10.21 Do not know how to progress

Problems related to this category occurred when the users had just started to use the program. Most were unable to move ahead. This was true in all three: the Walk, the Office, and the Plan.

The first encounter

The Office screen is a photographic representation of a farm office with a 'Television' , a 'Video cassette Recorder', a stack of 'Files' and a 'Computer' (Fig. 10.2). Also there is a 'Map' of the farm on the wall and a 'Window' overlooking the farm. The menu bar at the bottom of the screen shows clickable words 'Info', 'Menu', 'Walk' and 'Plan'. By selecting each word the user could navigate further into the program and get more information from various sections.

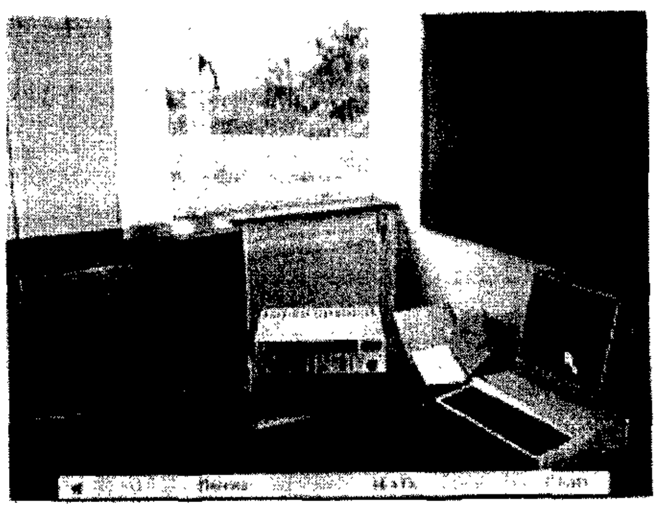

Fig. 10.2: The Office

Steven selected 'Office' from the menu bar after listening to the video. He was unable to proceed:

> I'm stuck

When the Office screen appeared he needed to select an item from this photographic representation of the Office. It appeared that Steven could not figure out how to move ahead. I briefly explained the structure and the navigation procedure within the Office. I also explained the function of 'Info' on the bottom menu bar from which he could get textual help and listen to the 'Guide'. Finally I directed him to select 'Info' and listen. Even after my suggestions he waited for some time without doing anything. It appeared that he was unable to understand what to do next. Robert and Duncan were other users who faced the same problem.

Similar problems occurred when the users were in the Walk section too. When the user selects Walk on the bottom menu bar, the Walk screen appears (Fig. 10.3). It is a photographic representation of a location of the farm. The Walk section consists of a large number of such photographs. The typical walk screen consists of a direction indicator at the top left of the screen, a group of arrows at the bottom left corner of the screen and a menu bar at the bottom of the screen.

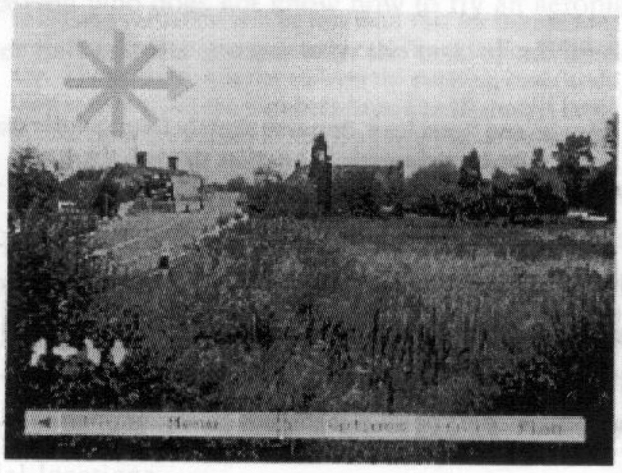

Fig. 10.3: The Walk

Section 3.31 of Chapter 3 decribes the navigation procedure within the Walk.

Duncan faced a problem when he came to the Walk. He selected the 'Walk' after being in the Office. I briefly explained the learning objective within the Walk. But navigation was a problem:

> How do you proceed from now then? Do you click on here (the direction indicator), or?...

Perhaps Duncan found the Walk screen to be somewhat complex because of the icons and various clickable words on the menu bar. I suggested that he should select 'Info' and listen to the 'Guide', which he did. Listening to the Guide may have helped him understand the structure of the Walk and the navigation procedure within the Walk. Afterwards he again faced a problem as to how to get back to the Walk screen. However, with help Duncan was able to access information from the Walk. Simon and William were other users who faced the same problem.

These users had no previous experience of learning from multimedia. They just started to use it. The beginning of the program was easy. After my brief explanation of how the program works, I directed them to select 'Simulation' from the screen. The introductory videoclip instructed the users to select either the 'Walk', the 'Office', or the 'Plan'. This instruction was also very direct. At this point, however, I suggested that they use either the 'Walk' or the 'Office' first. Once they selected any of these sections they were on their own. All they saw was a screen with different icons. At this point the farmers were 'stuck'. They did not know how to proceed from there. Also they did not know how to use the graphical screen. They had a slight understanding of what information was available within each sections because they had listened to the introductory videoclip. However, that understanding was inadequate.

Conklin (1987) identified 'getting lost in the hyperspace' or 'disorientation' as the major problem that hypertext users face. As far as the farmers were concerned, their 'getting lost in the hyperspace' at the first encounter was characterised by not knowing what was available or how to use the interface to progress. This situation is somewhat similar to putting a person who does not know how to fly an aeroplane in the cockpit. The user has a tracker ball and the screen, with the task of navigating in the program.

Further navigation

Once the users enter the Walk, the Office and the Plan, they need to carry out further manipulations with clickable words and icons. Users had difficulties in this process. A simplified diagram of the structure and various paths of navigation (see Fig. 10.4) will be used for analysing these problems. Arrows show the directions of navigation within each section and between sections. To simplify the diagram, only the forward navigation is represented by arrows. The user can always go backwards and where possible, can move towards parallel locations.

In the Fig. 10.4 there are six layers:

1. Layer 1 is the main menu (see Fig. 10.1).
2. Layer 2 is the introductory videoclip. The user reaches it by selecting 'Simulation' from the main menu, then can select either the 'Walk', the 'Office' or the 'Plan'.
3. Layer 3 is the three sections. For the Walk the user remains in layer 3, using the arrows at the bottom of the screen and getting panoramic view by selecting left and right of the screen. In the Office the user needs to go to the next layer for further navigation.
4. Layer 4 is an intermediate level that applies only to the Walk. The user goes through this level to go deeper into the program. Within the Walk screen the user clicks on 'Options' and to go to layer 5. For the Office the user by passes Layer 4.
5. Layer 5 is another intermediate layer before getting the actual information. This layer is characterised by lists and menus from which the user selects information. For instance, within the Walk the user sees a menu showing 'Guide' and 'Help', plus lists of plants and animals. Within the Office the user would come across a menu showing 'Guide', 'Help', a list of interest groups, a list of 12 case studies and a list of farm accounts.
6. Layer 6 is the actual layer where the user gets desired information. As the illustration shows the user may by-pass layer 4 and 5 in some occasions. For instance, by selecting 'VCR' within layer 3 the user can view a video containing background information on the farm. However, the user always needs to go through layers 4 and 5 to look at photographs of plants and animals. All the information the user can get within Layer 6 is listed in Fig. 10.4.

As the user goes deeper into the program, depending on the section the user is in, the screen and the menu bar change. These changes are not shown in Fig. 10.4 as it would have made the diagram too complicated.

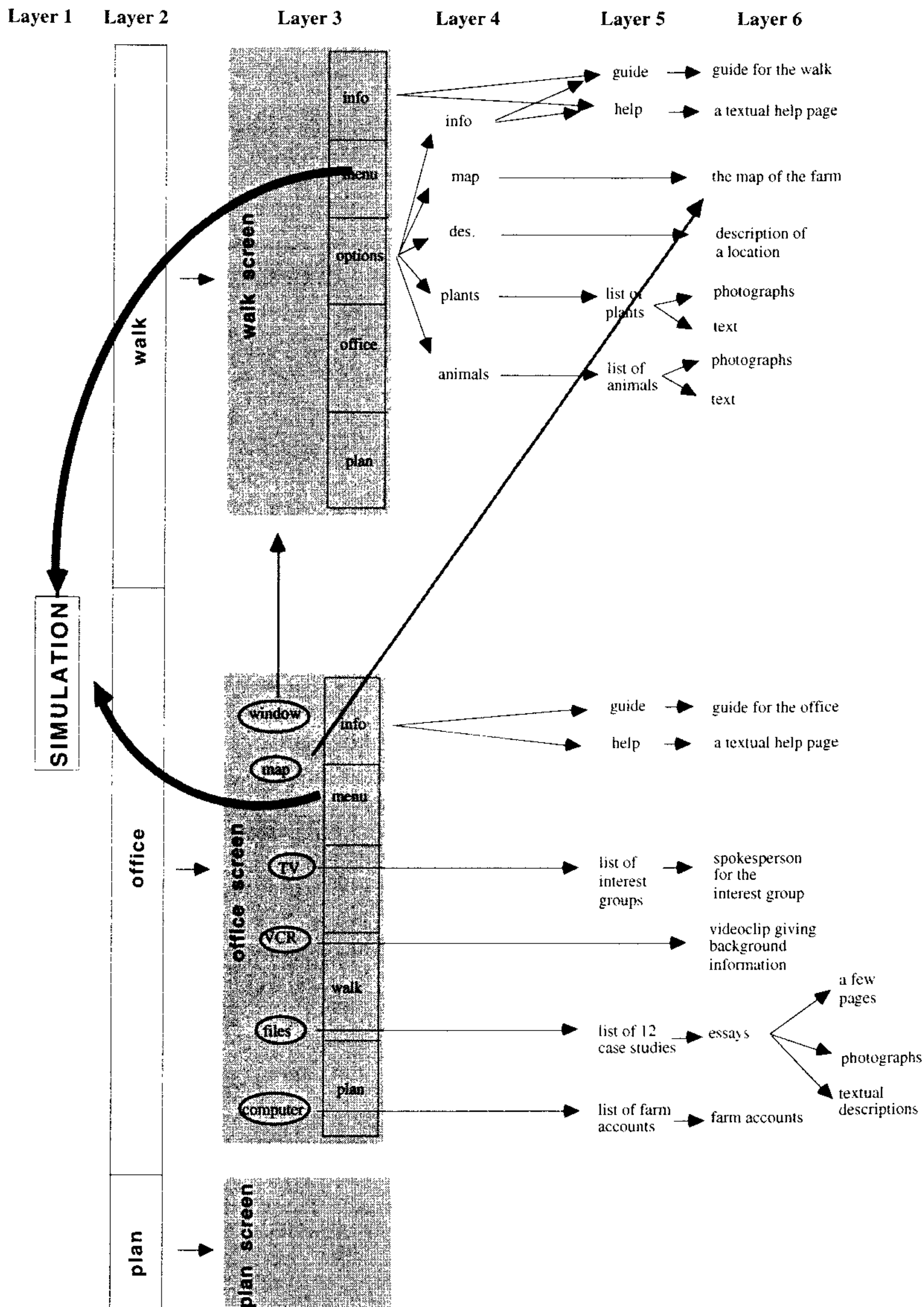

Fig. 10.4: A schematic representation of the structure and various paths of navigation

Users faced four types of problems in their further navigation:

- How to move between two main sections
- How to access more information within the same section
- How to move to a parallel location
- How to go back to the original screen of the same section

How to move between two main sections

This type of problem occurred within layer 3 when the user wanted to move from one main section to another. In this case the users knew where they wanted to go or what information they wanted to access but were unable to work out how to do it. The users were trying to move within layer 3.

In this particular case, Steven wanted to move from the Walk to the Office. He could not get the menu bar that gave him the option of selecting the Office. Instead, he continuously selected various words on the menu bar, calling up many unwanted screens.

First he selected 'Options' on the menu bar of the Walk screen. The bar changed. Second he selected 'Info' from the new bar. This changed the menu bar giving him four options including the 'Guide'. He selected the 'Guide' but soon realised that he was wrong. So he selected 'Return' that took him back to the previous Walk screen. His confusion about the navigation procedure continued and he was not able to get to the screen he wanted:

> I have got a bit stuck in ... .
>
> ... go back to the guide again I think.
>
> Info I should think...
>
> ... that's help again.
>
> ... back there again you see.

When I realised that he was not able to get the screen he wanted by himself I helped him. Eventually he found what he wanted:

> That's it, I wanted to go back to the ... Office

How to access more information within the same section

This type of problem occurred when the user was in layer 3 and wanted to access more information within the same section. Following were four types of problems users faced:

- accessing the 'Map' within the Walk section
- accessing the location 'Description' within the Walk screen
- getting to the next pages of an essay
- accessing the figures linked to the case studies

One example of the first type was when Robert wanted to get to the 'Map' while he was in the Walk screen. He was trying to think how to do it while moving the pointer along the menu bar:

> ... to go back to the original (the 'Map')....

The discussion I had with him prompted him to think about the navigation procedure at this point. When the user is in the Walk screen the menu bar does not show clickable words such as the 'Map', the 'Description', the 'Plants' and the 'Animals'. What the user can see are 'Options', 'Office' and 'Plan'. The user needs to select 'Options' to get the options of looking at the map, a description, a list of plants and a list of animals. Robert took some time to realise that he needed to select 'Options':

> I see, 'Plan' I think, oh no 'Options'.

When he selected 'Options' he saw the clickable word 'Map':

> Ah! there is the 'Map' now.

Afterwards he used the map and the location 'Description' to find out his location and to move to new locations.

An example of the second type of problem was when Robert wanted to get a location description. Robert wanted to do it just after accessing the map, an almost opposite manoevure:

> How do I get back to...? ... . this (indicates the location Description)

But he was able to recall how to access the 'Description' immediately. He asked whether he needed to select 'Options' first, and did not wait for my confirmation. After selecting 'Options' he could see that the menu bar had changed to show other words including 'Description', and he went ahead asking if he needed to select 'Descriptions' now. On this occasion he could remember the navigation procedure but was not sure whether he was right. He needed a little guidance.

The third type of problem, getting to the next pages of an essay, occurred when Robert was looking at mini case studies. He read the first screen of the first case study he had chosen. He wanted to go to the next page:

> How do we go to the next page?...

In this program the user needs to take the pointer to the right of the screen and press the 'Change' button in order to go to the next page. I explained this process and Robert was able to go through the rest of the case studies without difficulty. He continued to read 9 out of the 12 case studies, spending nearly twenty minutes reading and taking notes.

Neil, Duncan and Simon faced the same problem.

An example of the fourth type of problem, accessing the figures linked to the case studies, occurred when Neil looked at figures that were mentioned in the essay. In the essays certain points are illustrated in photographs with textual descriptions. When he was reading an essay on 'Boating', Neil wanted to know how to get the figures:

> Right OK, where do I get these figures?

I explained how to look at the figures and read a textual information for the photographs.

How to move to a parallel location

This type of problem occurred when the user wanted to access pieces of information in a parallel location, such as when the users were in level 6 and were trying to access information within the same level. Robert faced a problem when he tried to access the 'Map' while he was looking at a picture of an animal species. Within the screen with the animal's photograph, he selected 'Info'. When he realised that it was not the proper procedure, he selected 'Return' followed by selecting the ↵ icon. This took him back to the Walk screen with arrows. He wanted to get the 'map', but was not sure how to do it:

> Mmm!... menu, I did that, that was wrong, 'Options' is that right?

From previous experience Robert remembered that selecting 'Menu' returned him to the beginning of the program. It took some time for him to realise that he needed to select 'Options' first in order to get the map. After that he selected 'Map' on the menu bar. Once he managed to get the 'map' he continued to move to several different locations on the farm.

How to go back to the original screen of the same section

This type of problem occurred when the user wanted to go back to previous levels. Following were six main navigational difficulties users faced:

- from the location description to the Walk screen
- from the 'map' to the Walk screen
- from the essay to the list of essays
- from the text to the 'Guide' screen
- from 'guide' to Office
- from 'guide' to Walk

An example of the first types of difficulty was when Robert wanted to move from the location description (see Fig. 10.7) to the Walk screen (see Fig. 10.3). That was the screen one uses to walk on the farm:

> I can't get rid of the text ...

When he moved to a new location on the farm he would usually select 'Description' to get the photograph and the textual description of the location. This screen does not allow the user to walk around using arrows; the user needs to get the screen with arrows in order to walk around the farm. It appeared that even though Robert knew what he wanted, he was not able to do it.

I advised him to select the ↵ icon on the screen. He was able to get to the Walk screen with arrows and without the text.

Neil and Duncan were other users who found the same difficulty.

An example of the second type of difficulty was when Steven wanted to move from the 'map' to the Walk screen:

> I want to get off this 'map', I want to get back to the picture bit (the Walk screen), so I get back to the 'Guide', do I?

In order to go to the Walk screen he thought he needed to get back to the 'Guide', which was not the correct procedure. I explained that he needed to select 'Return' in order to go back to the previous screen, which was the Walk screen.

At this point I decided to explain how to navigate within the Walk. I showed that he could select 'Options' on the bottom menu bar and get four options: getting the map, reading a list of plants, reading a list of animals and getting a description of the location. I took him through this process step by step, and it appeared that Steven then understood how to navigate:

> (reads the description of the place) I see, so then go back onto this one and moving around the map I should be able to work out where I am ...

From then onwards Steven walked around the farm using the navigational skills he learned.

William too faced the same difficulty.

The third type of navigational difficulty, moving from the essay to the list of essays, occurred when Simon was reading an essay within the Office. After reading the a page of the essay he wanted to know how to get back to the original essay list:

> How do I keep going through the lot?

I discussed this point with him and he was able to understand how to get the list.

An example of the fourth type of navigational difficulty, moving from the text to the Guide screen, occurred when William just finished reading a page of textual information attached to the 'Guide' for the Walk. He wanted to back a screen, and found it difficult:

> So to get back to that original one
>
> Go to 'Return', don't I?
>
> Just want to go back to, 'cause that actually just gives me a 'Role', doesn't it? I want to go back to, now (selecting 'Return') where's that going to take me, I wonder.

He wanted to go to the previous screen with the menu. 'Return' was not the correct choice. He should have selected the ↵ icon on the screen:

> It's going to take me to Office, is it? Never matter, 'Info' I suppose I go to.

He ended up in the wrong place. He then selected 'Info' and had to listen to the whole video of the 'guide' for the Office in order to get the original list:

Oh! I see now, I've got to go back through this again, have I?

An example of the fifth type of navigational difficulty, moving from Guide to the Office, was faced by Duncan after he had listened to the guide for the Office. Duncan wanted to go back to the Office screen. But he was not sure of how to do it:

> So do I click back on 'Office' now then, if I want the Office, or?

Fig. 10.5 shows this particular situation. Duncan had just finished listening to the 'guide' for the Office. The last frame on the screen shows the picture of the 'guide' and the word 'Office' on the left of the screen and two words on the right of the screen. Duncan thought that he had to select 'Office' in order to return to it. That was why Duncan asked '...click back onto 'Office'...' In fact what he needed to do was to select 'Return' on the menu bar.

Fig. 10.5: 'Guide' for the Office

I explained the process of going back to the Office. I also suggested that he read the textual 'Help'. After reading the help page he selected 'Return' to go back to the Office, according to my instructions.

Simon, too, faced a similar problem.

The sixth type of naviational difficulty, moving from Guide to the Walk, was faced by Duncan after he had listened to the Guide for the Walk:

> How do we carry on? ... . Right, how do you actually get back onto the Walk then?

His problem was how to get to the Walk screen from the screen he was looking at. I helped him by directing him to select 'Return' to go back to the Walk section.

Simon and William faced similar problems.

Discussion

The problems discussed under the section 'Further navigation' (section 10.21) occurred in a context where the users knew what information they wanted within the program but did not know how to access it. There were four main problems highlighted:

- how to access a main section while in another main section (the Walk, Office, and Plan)
- how to access more information within the same section
- how to access information from a parallel location, and
- how to get back to the immediate previous location

The above problems can be explained in terms of Conklin's (1987) notion of 'getting lost in the hyperspace'. According to Mayes et al (1990) and Allinson and Hammond (1989), the users got disoriented: they did not know where they were in relation to the other parts of the information network. Also they could not find information that they knew was somewhere in the system. Elm and Woods (1985, cited by Edwards and Hardman, 1989) identified three forms of getting lost in a hypermedia program: not knowing where to go next; knowing where to go but not knowing how to get there; and not knowing where they were in the overall structure of the document. Nielsen (1990, p. 127) too identified similar forms of disorientation of learners who made comments such as '... I was often confused about where I was' and '... I was often confused about how to get back to where I was'. Gay and Mazur (1991) too observed similar phenomena when learners used a hypertext program called 'Bughouse' which used the metaphor of a house to arrange information. They found that though the users were aware of the overall design and scope of the program, it was possible get lost in the course of specific moves. Though the users realised that certain information could be found only outside the 'house', they were unable to locate the door which would allow them to leave the house – 'they knew where they wanted to go, but they could not figure out how to get there' (Gay and Mazur, 1991, p. 273). The other problem observed was that users found it difficult to return to items of information that they have previously visited.

It appears that the farmers were facing similar situations while using the Countryside Disc. Some did not understand relationships within the system and as a result did not know their present location in the system. Consequently, they were not able to plot their path of navigation. This problem becomes more severe when the size and complexity of the hypertext increases.

In the Countryside study the farmers acquired most of the navigational skills and were able to access information from the program. However, as the next three sections reveal they missed out some important navigational tools. In some occasions they did not use the appropriate ones. These two problems had implications for how they learned from the program.

10.22 Missing important navigational tools

In order to get the information from the Walk and the Office sections, the user needs to use the navigational tools available within those two sections. Table 10.1 shows the list of such navigational tools:

Table 10.1: Navigational tools and their functions

The navigational tool	Function
'arrows' at the bottom of the screen within the Walk screen	to walk towards the direction shown by the arrow
selecting left/right of the screen within the Walk screen	to look left/right to get a panoramic view of the location
'Map' on the menu bar within the Walk screen	to know the location to move from towards a focused direction
'Return arrow' in some screens of Walk and Office	to get back to the immediate previous screen
The 'direction indicator' within the Walk screen	shows the direction the user is looking at in the Walk

There were instances when the users appeared to have no knowledge of the availability and function of these tools. They stuck to the navigational tools they knew, and were not able to try the others.

'Arrows' and the panoramic view

Tim was in the Walk section for nearly 15 minutes and during this time he was always using the 'map' to change his location. He never used the other two ways to support his navigation: the arrows at the bottom of the screen and selecting left and right of the screen. By selecting arrows at the bottom of the screen you can walk in the direction shown by the arrows. By selecting left or right of the screen you can look left and right respectively. By selecting on either side continuously you can get a panoramic view of the farm. Tim did not do any of these until he was shown how to use them. Later on he discovered how to get a panoramic view by selecting left or right of the screen.

Panoramic view

Neil had been in the Walk for nearly 21 minutes but did not look around the farm (the panoramic view) by selecting left or right of the Walk screen. When I mentioned this possibility, it appeared that he was not aware of it:

> Can you [get a panoramic view]?

I explained how to get the panoramic view and its usefulness for getting information from the Walk. Once he understood the procedure he continued to use it:

> Ah, right, keep doing [selecting the side of the screen] ...? ... Ah right

William was another farmer who did not know that he could get a panoramic view of each location .

The 'map'

Neil wanted to know of his location but was not aware of the existence of the 'map' within the program:

> So how do I know where I am? Stuck again. There is a road somewhere ... . What I want to say is, what you want to now know is where I am, don't I?

In the Walk, the user can see a photograph of the location he or she has selected. It also has arrows and a bottom menu bar for navigation, and the direction indicator. Just by looking at the photograph the user cannot find out his or her position in relation to the farm. So Neil wanted to know his position, but did not know how to get the 'map' of the farm. After I showed him how to access the 'map' from the Walk screen, he continued to use it in his walks.

Steven, Duncan, Simon and William were other users who were not aware of the map.

The 'direction indicator'

While William was in the Walk for some time I asked if he had noticed the 'direction indicator'. His reaction was:

> What's that do?

It appeared that he did not notice the 'direction indicator' at the top left hand corner of the Walk screen (see Fig. 10.3). It is an icon showing eight directions. The direction in which the user is looking at any particular time is marked by an arrow. When I explained the function of the direction indicator he tried to understand what it represents:

> I see, so it may, I'm looking across like that, compared to the map is it?

Discussion

Missing out important navigational tools may be caused by distraction, a problem users face when using hypermedia (Marchionini, 1988). Marchionini suggested that distraction in hypermedia is caused by the availability of a vast quantity of information that is easily accessible, a 'mouse click away'. As a result the learner may miss important information. However, this distraction could be equally applicable to the problem of missing out important navigational tools. Within the Walk there are several navigational tools. The user may miss some.

10.23 Not using appropriate navigational tool

Another problem was that there were instances when the users did not employ the appropriate navigational tool. On these occasions, the users knew of the tools but did not know how to use them in combination with other tools for particular manoeuvres and accessing particular information. This caused difficulties for the learning task.

The 'map'

Steven faced a problem when he was trying to go to a predetermined location on the farm. He was walking towards the north of the farm but was not able to do so with the arrows at the bottom of the screen.

I can't get up higher, trying to ... get north, but I can't.

He was looking for the farm buildings:

I want to go to farm buildings, but I can't go there.

When the user clicks on an arrow at the bottom of the screen he or she can move in that direction. However, after using a few consecutive arrows, the user may lose orientation because it is not possible to relate to a reference point on the farm. This usually happens if the user wants to walk a long distance, such as from the south end of the farm to the north end of the farm. Many users faced this problem.

The best method would be to use the 'map' to walk to a predetermined location. Fig. 10.6 shows the map.

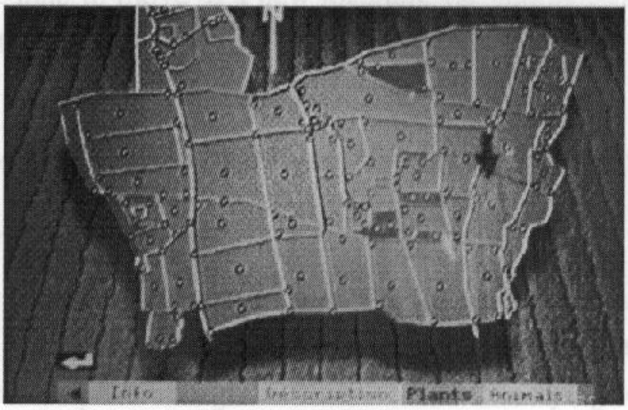

Fig. 10.6: The 'map'

The user has to call the 'map' from the location he or she is in at the moment. A yellow arrow – the location indicator – marks the current location. The user must move the location indicator to the preferred location on the farm and select 'Options' on the menu bar. The menu bar changes (see Fig. 10.9) giving the user the opportunity to look at a photograph of the new location together with a textual description. The user needs to select 'Description' on the new menu bar and can get the location description as illustrated in Fig. 10.7.

Fig. 10.7: The 'description' of a location

At this point the user may select the 'Return arrow' that can be seen on the bottom left corner of the description screen. This takes the user to the Walk screen with the arrows. There, the user can use arrows to walk short distances or select the sides of the screen to look around to see if he or she is closer to the point of destination. The use of the 'map' to change the location is of vital importance to walk around the farm. Steven was not aware of that.

I showed him how to move his location. Once he grasped the technique he was happy that he could move from one location to another without trouble:

> Yes, now I am with you, couldn't get from A to B!

From then onwards, Steven used the 'map' to move his location rather than always trying to use arrows on the Walk screen alone. His typical navigation consisted of changing from one location to another using the map; reading a description of the location; going to the Walk screen to use arrows to walk around the chosen location; and finally using the map to move to a new location. He was satisfied that he was getting to know the farm well:

> Now getting the hang of it, what the farm looks like...

Other users who faced the same problem were Duncan, Simon and William.

The walking 'arrows'

Robert knew that he could use the arrows in the Walk screen to walk around. However, he did not use them in his walks. Unlike the previously discussed users, he continuously used the 'map' to change his location. He was trying to find the disused railway station on the farm. Using the 'map' to move around is helpful when the user wants to move a long distance, or even from one field to the adjoining field. But movement is not flexible when one needs to find a specific feature on the farm. Moving using the arrows on the Walk screen is a fine-tuning method for that kind of navigation. I suggested he should use the arrows in order to find the disused railway station. However, just as he started to use arrows he found it. Had he used the arrows in combination with the 'map', he could have found the location earlier. Then he continued to use the arrows in addition to the map for his walk.

The panoramic view

A few minutes after suggesting that Simon should use the 'map', I showed him how to get a panoramic view of his location. Later on too I showed him how the panoramic view is useful to see if he has reached his destination. By using all the navigational tools he was able to move in the direction he wanted.

The 'Return arrow'

Duncan was in the Office listening to the interest groups. Fig. 10.8 shows the screen when the user listens to a spokesperson of an interest group.

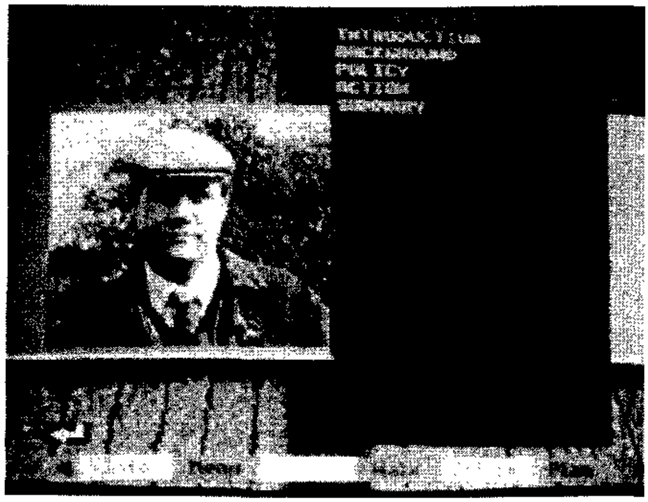

Fig. 10.8: Spokesperson of an 'interest group'

He listened to the first interest group's spokesperson and was about to select 'Office' in the menu bar to go to the Office again to listen to another of the interest groups. This navigation procedure involves three steps: going to the Office by selecting 'Office'; going to the television by selecting 'television', and finally listening to the interest group by selecting the desired one. In fact, the user does not have to go to the Office every time he wants to listen to a new interest group; he can bypass the Office. He only need to select the 'Return arrow' on the bottom left hand corner of the screen (Fig. 10.8). That takes him back directly to the list of interest groups. When I mentioned this to Duncan, he was not aware of it and wanted to know how it is done:

> What's the other way?

I explained the procedure to him. After that he continued to listen to the interest groups, employing this short cut method of navigation.

Discussion

In the above examples the users were aware of the existence of particular navigational tools. But they were not able to use these navigational tools in combination with other tools in order to carry out particular manoeuvres or access particular information. Examples were:

- the need to call the 'map' to find the location and to move to a new location; using location description to get a description of the location; using ↲ to get back to the Walk screen
- the need to use 'arrows' and 'panoramic view' to find a particular location
- the need to use the 'Return arrow' to get back to the previous screen, thereby reducing the number of steps involved.

Not being aware of how to use navigational tools appropriately caused a number of problems. For instance, carrying out certain manoeuvres such as moving to a predetermined location was difficult. For such a move the user is required to use arrows and panoramic view in addition to using the 'map'. 'Map' is helpful to move between long distances within the farm. Arrows and panoramic view help the user to move within a locality. On the other hand, to move long distances, arrows are not the best navigational tools. Use the map for that. By not using appropriate navigational tools the users get tired and frustrated. This situation had serious implications for learning such as losing concentration and motivation and not being able to access information required.

10.24 Missing vital information

The users seemed to miss out some vital information from the program. They were not aware that this information was available.

The Office

After spending nearly an hour in the Walk section, Tim indicated that he was ready to go to another section. He thought he had completed getting information from the program. He was not aware that he had not looked at the Office section so far. Office contains vital information such as farm accounts, background information about the farm, opinions of different interest groups and some case studies (see Fig. 10.2). He was going to miss this section altogether unless I suggested he should go to the Office.

The location 'Description'

Duncan had been in the Walk for some time but he did not read descriptions for the locations he chose. He was using the 'Options' to change the menu bar so that he could select 'Map', 'Plants' and 'Animals'. The fourth clickable word on the menu bar was 'Descriptions' (Fig. 10.9) which he did not select. I pointed out that he could read a location description of any point he had chosen. It appeared that he was not aware of it:

> Yes, where is that?

I showed him how to read a location description. I emphasised the fact that whenever he saw a clickable word such as 'Description' or 'Text' he could get a textual description of the item being displayed.

The list of plants and animals

Steven moved to the Office from the Walk and did not look at the list of plants and animals. I pointed out to him that he had missed the plants and animals within the Walk. He explained that he had looked at different kinds of crops that were grown on the farm but did not know that he could look at the wildlife on the farm:

> I saw what crops were growing on it, there was maize, and grass and wheat. I didn't actually ... , you know.
>
> They give the weeds and wildlife?

When he was aware of that option he wanted to go to the Walk again and look at the wildlife:

> Perhaps we should go back on to that one.

Afterwards Steven went to the Walk again and started to look at the lists of plants available on a couple of locations of the farm.

The lists of plants and animals can be accessed via 'Options' on the menu bar. Fig. 10.9 shows the menu bar after selecting 'Options':

◀	**info**	**Map**	**Description**	**Plants**	**Animals**

Fig. 10.9: The menu bar after selecting 'Options'

Steven had come across this menu bar previously. He had used both the 'Info' to listen to the 'guide' for the Walk and 'Map' for walking on the farm. However, he missed the other two clickable words, 'Plants' and 'Animals'.

The photographs of plants and animals

Tim too was going to miss out some of the sections within the Walk. He looked at the lists of plants and animals. However, he was going to miss the photographs of the wildlife together with their textual descriptions. When I realised this I pointed out that he could access photographs of plants and animals. To look at these photographs, you need to place the pointer on the species that you want to look at and press the action button on the tracker ball. The photograph appears. At the same time the bottom menu bar changes giving the user a few more options to get more details. Fig. 10.10 shows how the menu bar changes after selecting a plant:

◀		**List**	**Text**	**Plants**	**Animals**

Fig. 10.10: The menu bar after selecting a plant

By selecting 'Text' the user could get a textual description for the wildlife he or she was looking at. Once he got this help, Tim went on to look at photographs of plants and animals at several locations in his walk.

Steven, Robert, Duncan and Simon were other users who were going to miss photographs of wildlife because they were not aware of it.

The 'Files'

Steven listened to a few of the interest groups (on the 'television') and obtained background information (by selecting the 'VCR') while in the Office. After that he moved to the Walk. He missed the 'computer', the 'files', the 'window' and the 'map'. It appeared that he did not notice these four items in the Office. Later on he came to the Office twice. The first time he did not indicate that he had noticed the missing sections. But the second time he looked at the 'computer' and took notes of farm accounts. Still he missed the 'files'. Towards the end of the session, I asked him if he had noticed the 'files', but it appeared that he had not:

> Oh! that one. I didn't see it

He decided to read the files later on during the week.

Duncan and William, too, did not know that they could access mini-case studies via the stack of 'files'.

The 'Television'

Robert too, faced the same type of problem. He completed reading the case studies he had selected. By this time he had gone through three items in the Office – the 'VCR', the 'computer' and the 'files'. He selected the 'television' whereupon the list of interest groups appeared. He moved the pointer along the list of interest groups but did not chose any. After a while, he selected 'Return' to go back to the Office screen.

Later in the session I mentioned about the 'television' interest groups when he had completed information gathering from the Walk and the Office. He said:

> Interest groups? Do I have to go back to the Office?
>
> I looked at the 'television', there was a list of mm ... like NFU. You suggest I listen to that?

He did not give a reason for not listening to the interest groups earlier. It appears that he was not aware of the fact that he could select each of the interest groups and get a short videoclip of their views. Once he knew that this information was available he listened to all the twelve interest groups and took notes where necessary.

The 'Video Cassette Recorder'

William was in the Office and completed looking at the farm accounts. Then he wanted to go to the Plan without looking at the 'VCR' or the other sections in the Office. He was going to miss these sections though he had noticed them at the beginning. I suggested he should listen to the farmer (Poul Christiensen who currently runs the farm depicted in the program) by selecting the 'VCR'. Afterwards I suggested he should go to the Office to listen to the television interest groups. After listening to the videoclips, he went on to read textual descriptions by selecting words appearing in the right hand window.

Discussion

Missing vital information is a result of 'distraction', a problem inherent in hypermedia as a learning environment (Marchionini, 1988). Distraction occurs when the learner is given total control over the selection of vast quantities of information in the learning program. According to Marchionini, the learners can miss relevant instructional points entirely.

In this program, information is accessed by selecting clickable words on the screen. For instance, within the Walk, by selecting 'Options' (on the menu bar) the user can see a screen with a menu giving five options: 'Info' to get the 'guide' and 'help'; 'Map' to get a map of the farm; 'Description' to get a location description; 'Plants' to get a list of plants; and 'Animals' to a get a list of animals. All these are clickable words and give more options. It is possible for the user to miss out some information when there are many options to select from. The implication for learning is that by missing vital information the user may not be able to arrive at the level of understanding required to carry out the learning task.

10.25 Misinterpreting information

There were instances when the users misunderstood about certain manoeuvres and iconic representations. These too are important because such misconceptions can lead to wrong interpretation of information and difficulties in carrying out the learning task.

Manoeuvres

Accessing information within the multimedia resource

Duncan was listening to the interest groups in the Office. After listening to the first one, he choose to read a textual description. Then he faced a difficulty:

> Where do I go next?

I suggested that he went to the Office again so that he could continue to listen to the interest groups. But he thought he would be going back to the beginning of the introductory videoclip again:

> No. Well, I want to carry on forward actually, I want to go somewhere else I think, but I don't want to start the actual initial video again.

At this point I explained that he would not be going back to the introductory part unless he purposely selected 'Menu'. On a previous occasion he went to the beginning of the program by selecting 'Menu'. So he was somewhat cautious about selecting any icon. After my explanation he realised that he needed to be aware of 'Menu':

> Unless you go back to the 'Menu' again? Right I won't go back to the 'Menu'. OK.

After he had read the textual information for the selected interest group, the screen consisted of the text, return arrow, menu bar with 'Info', 'Menu', 'Walk', 'Office', and 'Plan'. His concern was that if he clicked the wrong word, he might end up listening to the initial videoclip from the beginning. He had the same worry even later when he had just finished listening to the videoclip of the farmer in the Office. He wanted to go to the Office. The way to do it is to select the return arrow but he was worried it might take him back to the Office:

> If I press 'Return' [arrow] now would that take up back to the start of that video or back to the Office?

Still he questioned how the program worked when he selected the 'return arrow' – would it take him back to the Office or to the introductory video? I reassured him that pressing the return arrow would take him back to the Office.

After the explanations he wanted to know where to go next:

> That's the ... ., right where shall we go now then?

I suggested he should select 'Office' to go to the Office section again.

Moving the location

Robert tried to learn how to move his location using the map within the Walk section. The map shows all the 47 fields, woodlands, farmyards and other features of the farm. Borders of each field have been marked on the map. In each field there is one or more dots. These dots represent points of information, i.e., those are the places where the photographs have been taken. Robert thought he needed to click on these points in order to move to that particular field:

> Do you have to point on a dot to get a? ... any point?

When he pointed at a point and press 'action' button on the trackerball, the blue arrow that indicates the location moved to that point. Robert was not really aware of what was happening:

> What is happening? Is that a blue ...?

I explained that the blue arrow is the location indicator. Then he saw that the menu bar gave him the option of reading a description. He thought he needed to select 'Description' at this point:

> Do a 'Description'?

Perhaps he tried to bring in his computer skills that he had been mastering for the last couple of months. He had just bought his first computer and been using it for his farm management record keeping and budgeting. He tried to look at the place on the 'map' by double clicking.

Accessing description of 'Plants'

Robert was looking at a photograph of a plant and wanted to read a textual description. But he was not aware of how to do it:

> You will have to pick one, do you?

He was asking whether he needed to select an individual plant from the photograph in order to get a textual description. I explained that he needed to select 'Text' for the textual description. Once he acquired this knowledge, he continued to look at wildlife species while he was on the Walk.

Using 'Panoramic view'

Robert found the panoramic view a difficult concept to understand. He thought by clicking on the same side one could go round in a circle:

> If I keep pressing the same one (arrow) then do I go around in circles?

At this point I clarified the matter. Robert chose a location on the farm with some trees as a marker to test out the panoramic view:

> Oh I see that tree (in the middle of the field, trying to use the tree as a marker to experiment with the panoramic view)
>
> If I click here.
>
> That's the hedge.
>
> If you go around like this you should come around the circle, ya?

He kept clicking eight times on the same side of the screen. At the eighth click he could see the same screen he started with. He understood the phenomenon:

> Yes!

Duncan and William too faced similar problems with regard to the panoramic view of the farm.

Using the 'Guide'

Later in the learning session, just before taking a break for lunch Robert wanted to know about listening to the 'guide' anytime as mentioned in the introductory videoclip:

> What did it say? Talk to that guy any time? ... The guide who gave the introduction?

I explained that it is one way of getting help and he needed to select 'Info' first.

> 'Info', go into something, anything can you?

Once he selected 'Info' the menu bar changed to reveal the words 'Return', 'Guide' and 'Help. I explained the functions of all three. He selected 'guide' that gave a short videoclip of the 'guide' for the Office. After listening to that he indicated that he understood the fact that he could get the 'guide' for the other sections as well:

> So anywhere, if you were on ... if you were on farm walk or something.

I confirmed that his understanding was correct. He went to the Walk and listened to the 'guide' for the Walk.

In the introductory videoclip the presenter mentions the 'guide'; he says that the user can call the 'guide' or 'help' anytime. Robert did not call the 'guide' or the textual 'help' while he was getting information from the Walk and Office sections. He remembered a piece of information about the 'guide', but it was not enough for him to go and listen to the 'guide' or get a textual 'help'.

Simon was the other user who faced problems using the 'guide'.

Using the 'Return'

Another problem Simon faced was the function of the 'Return' after listening to the guide:

> Right, if we go back to 'Return' it will take us out of the Office, presumably.

Selecting 'Return' will take him back into the Office, not out of the Office. The 'guide' explains this but the user was not able to get the total meaning. I explained both these situations. Simon decided to go to the Office.

Navigating within the Walk

After reading a couple of essays Simon decided to go to the Walk. When the Walk screen appeared he thought he needed to select 'Options' to use the Walk:

> We've got to go through 'Options', have we?

He had a vague idea perhaps that he needed to select 'Options'. But it did not represent full understanding. So I suggested he should listen to the 'guide', which he did. After listening to 'guide' he still had a problem as to how to start:

> So now I have to go 'Background' of the screen at it will start going will it?

Iconic representations

The 'Direction indicator'

At a certain point I explained the function of the 'direction indicator' to Robert. The 'direction indicator', the inactive icon on the top left hand corner of the Walk screen (see Fig. 10.3), shows the direction in which the user is looking on the farm at any time. As I was explaining he remembered a piece of information related to the Walk which he heard from the introductory video:

> I think there was some instruction there, 45 degrees at a time ... .

What he was referring to was related to getting a panoramic view of the farm. Once in the Walk, the user could click on the left or right of the screen in order to look 45 degrees left or right. If the user clicks continuously on one side of the screen, it is possible to see a panoramic view of the farm, turning to that side 45 degrees at a time. This is useful to get a view of a particular location while standing on the same place. Robert seems to have misunderstood the information. I explained how to get the panoramic view.

Simon too had problems understanding what the 'direction indicator' represents.

The meaning of the word 'Plan'

William selected 'Simulation' and listened to the introductory videoclip. After listening to the videoclip he wanted to go to the Plan section:

> So I better go to Plan first and find out where I am.

William wanted to go to the Plan in order to find out where he was. The word 'Plan' meant a map to him, because the introductory video does not say exactly what each item is.

However, once William was in the Plan I explained it briefly because I thought he would be misled if he was going to explore the Plan section alone – he already thought the

'Plan' was a plan of the farm. So I explained that the actions grouped into 19 categories, and that by selecting each he could go further and make changes.

Discussion

This section showed the various misconceptions the users had with regard to what is represented by the icons and clickable words, and how to use the navigational tools. Marchionini (1988) suggested that a serious consequence of the 'distraction' that users experience in hypermedia is for users to 'form wrong interpretations of the information'. This problem did not cause serious harm to the learning process in the Countryside study since I was available for correcting such misconceptions. However, it is necessary to find ways to avoid such misinterpretation of information.

10.3 Implications for learning

Five specific navigational problems are identified in this section. They are:

- not knowing how to progress within the program
- missing important navigational tools
- not using appropriate navigational tools
- missing vital information, and
- misinterpreting information such as manoeuvres and iconic representations

The problem of not knowing how to progress within the program was two fold: users encountered problems (1) soon after they went into each of the sections and (2) while doing further navigation. As soon as they went into a section they were 'stuck' and did not know how to use the interface to move around. Also they did not know what was available within each section, though the introductory videoclip provided some information. Problems while they were trying further navigation were more complex and can be only described as being 'lost in the hyperspace'. Even though they knew what they were looking for they did not know how to get there. A negative consequence of getting lost is that the users may ramble through the knowledge base in an unmotivated and inefficient fashion, unable to link individual information screens and hence failing to understand the underlying concepts (Allinson and Hammond, 1989). This kind of experience may place an unnecessary cognitive load on novice users and reduce their efficiency of learning. The extreme examples in the Countryside study were the cases of Joyce and Ian who rambled for some time and were not able to complete the learning task (see Appendix 1 for a separate analysis of these special cases). Others too experienced most of the specific navigational problems, but with my help managed to complete the learning task.

Missing important navigational tools had serious implications for the approach to learning from the Countryside Disc. The use of a particular navigational tool determines how the user navigates within the program and accesses information. As a result of missing out some important navigational tools, the users stuck to those tools they were familiar with. For instance, if a particular user sticks to using only the 'map' to navigate, he or she can only browse the Walk section. This particular pattern of obtaining information was described as level 1 type in data analysis (Chapter 6). By doing this kind of navigation, the user is unable to collect detailed information on a particular location. In order to collect in-depth information you need to use a combination of the 'map', walking 'arrows', location 'Description' and 'panoramic view'. On the other hand, the use of arrows alone for navigation within the Walk limits the user to obtain only detailed information in few places. The user finds it difficult to move to desired locations just by using the arrows. Another consequence of missing out some important navigational tools is that the users tend to miss out vital information. For example, missing out the panoramic view prevents the user from having access to details of vegetation and topography of the locations selected.

Observations in the Countryside study showed that individuals did not use a particular navigational tool mainly because they were not aware of it. A particular approach to obtaining information was partly determined by which navigational tools the user knew about. Those who stuck to a surface approach did so partly because they were not aware of the tools that allow them to adopt a deep approach. By the same token, those who stuck to a deep approach were aware of the range of tools. So it is important that users are aware of most or all the available navigational tools.

Not using appropriate navigational tools caused the learners unnecessary problems in the navigation process. This became particularly important when the users wanted to find out specific information within the Walk. Some users were trying to find out such features as the 'disused railway station' but were not able to locate it or took a long time to locate it because they were trying either only the walking arrows or the map to move to that location. Such fine-tuning needs the use of both the map and the walking arrows. Some users found themselves not using the appropriate icon or clickable word in order to get back to previous screens. Instead they used unnecessarily long processes to go back. Learners were frustrated and they lost concentration as a result of such incidents.

Missing some vital information had consequences for learning from the program. It was possible to prevent serious consequences by my own interventions, but the program should be suitable for learners working alone. One learner was going to miss the whole section of the Office. Others were going to miss information from the 'Files', the 'Television', the 'VCR', etc. When learners miss vital information they may not have the understanding about the farm needed to complete the learning task satisfactorily. Also they may not know that they missed information. Misinterpreting information too may result in the same situation. It is necessary to overcome these problems.

10.4 Solutions for navigational problems

The complexity of the geography of the hyperspace causes the learners to lose their orientation (Mayes et al, 1990). The larger and more complex the hypertext, the higher the tendency for the user to encounter navigational problems. To some extent, the problem of disorientation is likely to diminish as users gain experience with the medium (Marchionini, 1988). However, it is necessary to find ways to overcome or minimise such navigational problems.

Most of the support mechanisms built into hyperdocuments are based on how we conceptualise the process of navigation through an information base. The word navigation has a strong similarity with geographical navigation (Robertson et al, 1981, cited by Van Dyke Parunak, 1991). This follows an analogy between data navigation and physical environment navigation: 'It is fruitful to recognise the direct parallel between navigating concrete environments, such as cities or buildings, and navigating data. After all, such parallels are implicit in the navigation metaphor ... .' (Canter et all, 1985, cited by Edwards and Hardman, 1989, p. 107). Van Dyke Parunak (1991) too pointed out that the similarity between the structuring of information in a hyperdocument and various locations and streets in a city.

The idea of navigation in a hyperspace being similar to navigation in a geographical space has led to the 'travel holiday' metaphor, on which most of the supporting mechanisms for using hyperdocuments are built (Allinson and Hammond, 1989). Nielsen (1990, p. 130) summarised that 'since hypertext is heavily based on navigation, it seems reasonable to provide the same assistance to hypertext users as one gives to tourists'. I shall discuss four main categories of assistance offered: visualisation of structure, guided tours, history mechanisms and search mechanisms.

10.41 Solutions suggested in the literature

Visualisation of the structure

Visualisation of structure is offered through a schematic representation of complex information as in a map or a diagram. Edwards and Hardman (1989) show two major advantages of having a map of any environment, be it a city or a database. Firstly, there is the opportunity to work out and use short-cuts to reach desired locations. Secondly, and more importantly, if the user/traveller is somehow distracted and/or becomes lost, there is a greater chance that he or she can regain his or her bearings and reach the intended destination. Maps indicate linkages between information. Maps can be used to travel within the system, as any frame can be selected directly from a map (Allinson and Hammond, 1989).

Visualisation of structure of a hyperdocument is helped by providing the user with a schematic representation, showing the relative positioning of the information nodes and how they are linked to each other. The need for visual guidance arises because users may not be able to get to a desired piece of information without considerable knowledge of the structure of the hypertext and their current position within this structure (Jones, 1987). In order to access a desired piece of information in a hypertext, the user often must know where this information is and where it stands in relation to the information currently being inspected.

There are three kinds of maps and overview diagrams available: two dimensional maps, three dimensional maps and fisheye view diagrams.

Two-dimensional maps

Two-dimensional maps are the basic types of visualisation. Gay and Mazur (1991) and Nielsen (1990) report studies of using two-dimensional maps to help learners use hyperdocuments. These maps help learners to find their way around and access desired content within the hyperdocument. These maps are helpful to get a global understanding of the structure of the hyperdocument. However, a single map may not be able to provide the necessary details of all the nodes and links involved. A solution is to show both global and local overview diagrams on the same screen at the same time (Nielsen, 1990).

Three-dimensional representations

Two-dimensional overview maps are limited in that they cannot show various levels of detail. Three-dimensional representations may overcome this limitation (Jones, 1987). Fairchild et al (1988) propose a three-dimensional graphical interface called SemNet. It represents a knowledge base in a three-dimensional space and allows the users to examine local details while still maintaining a global representation of the rest of the knowledge base. However, regardless of the strategies used to organise the display of a graph, the number of nodes and arcs can eventually be overwhelming (Fairchild et al, 1988; Jones, 1987). Two kinds of limitations were identified by Furnas (1986). First, as the number of objects to be displayed increases, the system's responsiveness decreases. Second, humans are limited in their ability to discriminate and attend to objects on the display.

Fisheye view

In order to overcome the above limitation, Furnas (1986) proposed a 'fisheye view' which shows the entire information space on a single overview diagram but in varying levels of detail. A fisheye view shows great detail for those parts of the information that are close to the user's current location of interest and gradually diminishing amounts of detail for those parts that are progressively farther away (Nielsen, 1990). In this way, fisheye view addresses the questions of what units of information to display and how to display these units (Jones, 1987).

Guided tours

The travel holiday metaphor calls for guided tours (Allinson and Hammond, 1989). Guided tours can be seen as a simple solution from the user's perspective; they remove the requirement for active search of information (Trigg, 1988, cited by Nielsen, 1990). A guided tour may be thought of as a 'superlink' that connects a string of nodes instead of just two nodes (Allison and Hammond, 1989). Within the guided tour users are guided around a sequence of information until the tour ends. Or else, users may have to select 'next node' to see more information. All nodes will have 'path' icons for use in moving back and forth along the selected guided tour. The system may also record the path of the tour and list in a separate window the names of all nodes previously visited (Nielsen, 1990). One advantage of hypertext guided tours over tourist guided tours is that the hypertext reader can leave the guided tour at any spot and continue browsing other information of his or her choice. It is possible for the learner to get back on the tour whenever he or she wishes. The 'guide' will be waiting (Nielsen, 1990).

Guided tours can be used to introduce new readers to the general concepts of a hypertext. Also it is possible to provide several guided tours for various learners with a range of special interest (Nielsen, 1990). However, guided tours bring the learner back to the passive, sequential linear form of information. They take the 'control' away from the learner. Even though guided tours provided the options of side trips, they cannot serve as the only navigation facility since the true purpose of hypertext is to provide an open exploratory information space for the users (Nielsen, 1990). Guided tours ought to be a fallback position for the user who finds difficulty.

History mechanisms

Overview diagrams provided solutions for navigation by providing an understanding of the structure of the information base at a global level. However, researchers observed several problems encountered by users while navigating in the local context (Nielson, 1990; Gay and Mazur, 1991) One problem is that users can lose track of their goals. Another frustration is that they find themselves unable to return to items of information that are of particular interest. In order to solve these problems, mechanisms can be built into hyperdocument to trace the learners' moves through the program. These records help the learner to revisit nodes.

Interaction history

The interaction history suggested by Nielson (1990) provides a diagram which shows the nodes and links which have been connected. Users can consult this on-line diagram as required.

Backtrack

Probably the most important navigation facility is the backtrack, which takes the user back to the previous node (Nielsen, 1990). The great advantage of backtrack is that it serves as a lifeline for the user, who can do anything in the hypertext and still be certain of getting back to familiar territory by using the backtrack. Since backtrack is essential for building the user's confidence it needs to fulfil two requirements: it should always be available, and it should be activated each time in the same way. Furthermore it should in principle be possible for the user to backtrack enough steps to return all the way to the very first introduction node (Nielsen, 1990). Almost all hypertext systems provide some form for backtrack but not always consistently; inconsistency in backtracking can give users trouble.

General history mechanisms

Some hypertext systems provide more general history mechanisms than simple backtrack (Nielson, 1990). For example some systems have history lists to allow users direct access to any previously visited node. Since users are most likely to want to return to nodes they have visited relatively recently, it is also possible to use a 'visual cache' where a small number of nodes are kept visible on the primary screen (Nielsen, 1990).

User-defined bookmarks

Hypergates and other mechanisms allow users to define bookmarks at nodes they might want to return to later. The difference between bookmarks and history lists is that a node gets put on the bookmark list only if the user believes that there might be a need to return to it later. This condition means that the bookmark list is smaller and more manageable, but also means that it will not include everything of relevance (Nielsen, 1990).

Search mechanisms

Search systems are based on traditional word search mechanisms where the program searches the occurrences of specified words (Gay and Mazur, 1991). Topics are alphabetically arranged, and there are numerous cross-references which enable readers to search the knowledge domain methodically.

Among these different support mechanisms available to users the most appropriate types for navigation are those that are spatially based, i.e., that present the information structure in a two- or three-dimensional form, rather than those which simply keep account of the names of the screens that the user has viewed, although Conklin (1987), using a two-dimensional representation, has demonstrated the difficulties that occur when links between data items become numerous (Edwards and Hardman, 1989).

10.42 Suggestions for the Countryside Disc

Suggestions to overcome the navigational problems in the Countryside Disc can be made based on both the literature and the experience gained in the Countryside study.

Using a suitable metaphor to organise information

In hypermedia programs, a metaphor or a series of metaphors can be used to organise information. The 'Bughouse', a hypermedia program to study various aspects of insects, developed at Cornell University (Trumbull et al, 1992; Gay and Mazur, 1991) used a Victorian farmhouse as a metaphor to structure information. Topics dealing with insects and food were placed in the kitchen, insects and music in the music room, insects and fear in the farmhouse's basement and so on. Objects in each of the rooms become entry points to the information. For example, if a student selects a ceramic bee in the kitchen, he or she is able to access information on collecting honey. In this way students are able to access information attached to the objects visible in the rooms.

The organising of information in the Countryside Disc takes a similar form. The Office and the Walk are the metaphors that have been used to order information within the program. However, the organisation of information within the Office seem to be more effective than that within the Walk. The observations showed that learners faced more problems navigating in the Walk than the Office. Accessing information from the Office was fairly easy: the users just had to click on each item and the particular information attached to it was displayed. It may be possible to redesign the Walk and use a suitable metaphor to access information within the Walk section.

However, the use of a metaphor to organise information is effective at a global level. Gay and Mazur (1991) reported problems when the users tried to find specific information. Other navigational aids are necessary to overcome such problems.

Visualisation of the structure

I applied this method to some extent in the Countryside study. When the users encountered problems I drew diagrams of the structure and explained the location of each information node. For the last farmer, I prepared a schematic diagram (Fig. 10.4) depicting the structure of the information in the Countryside Disc. The farmer consulted this diagram whenever he faced problems and managed to overcome navigational problems to some extent. Following were his reflections:

> It was helpful to start. Definitely. Otherwise I would have lost. I was able to refer to it occasionally,
>
> This (Fig. 10.4) made a lot of difference. I suddenly realised what I was trying to get, it was always difficult to get into what you really wanted, and I couldn't quite see how, you know, not being computer-minded.

On-line help options

During the learning sessions I helped the users when they encountered navigational problems. The level of such intervention increased as the study progressed and as I studied the range of navigational problems. In the pilot study, I more or less let them continue and find their way around themselves. From the beginning of the main study, I helped them when they encountered problems. The kinds of help given could be built into the program as on-line help.

Always listen to the 'guide' and read textual 'help' first

The user can get some understanding of the overall structure and the navigational methods by listening to the 'guide' and reading textual 'help' for each main section. However, many users did not do it until I advised them to do so. Those who accessed the 'guide' and the text 'help' were able to understand the overall structure of the program and what information is available within the section. Also there were some instructions as to how to access information. A mechanism that automatically prompts the users to listen to the 'guide' and read 'help' may be helpful. Listening to the 'guide' had a positive effect: users were able to understand more about the the global structure and how the system works. However, this alone proved to be inadequate, as the analysis showed. For instance, there were occasions when the users were not able to get to the previous screen even after listening to the 'guide'. Users encountered problems within the specific local areas.

Provide a demonstration of various navigational methods

The 'guide' can be supplemented with a demonstration of each manoeuvre. At the moment, the guide merely explains how to access certain pieces of information. These manoeuvres often involve more than one step and the screen changes as the user selects various clickable words and icons. Sometimes it may be too much for the novice user to remember the process and the user may get lost when each clickable word provides a few more options. For instance, to discover the 'map' the user needs to select 'Options', whereupon the screen and the menu bar change to display the clickable word 'Map'. Similarly, you need to select 'Options' to discover location 'Description' and other features such as 'Plants' and 'Animals'. To get back to previous screens you need to select 'Return' on the menu bar or the 'Return arrow' on the screen depending on the situation. To overcome this problem, the guide can be supplemented with an actual demonstration of how to access various pieces of information, with a separate window showing the change of screens and icons. I used this method during the observations: I used photographs of screen shots and showed the users the sequence of screen changes.

Taking the users through various navigational processes

Another method would be the 'guide' taking the user through the various steps involved in different navigational procedures. For instance the 'guide' could lead the user to click on walking arrows to illustrate how to use the Walk, rather than the 'guide' just mentioning that the user can click on arrows to walk. Another example is that the 'guide' could take the user through the steps of getting a panoramic view, change locations on the 'map', etc. In addition to these simple manoeuvres, the guide could take the user through some complex manoeuvres such as using the 'map' to change location, using the 'Return arrow' to get back to the Walk screen, followed by using arrows to find a specific location. During the Countryside study I used this method with success.

Drill and practice of manoeuvres

These specific manoeuvres and navigational tools could be built into a list and be provided as a separate help. The user would be able to select a specific topic and practice the manoeuvre until he or she is familiar with it. The list could include such manoeuvres as:

- panoramic view
- different ways of walking around the farm
  - to observe details only
  - to walk from one field to another and observe details
  - to just browse using the map
- location description, etc.

It is important to include more complex manoeuvres in this list and perhaps build a search mechanism so that whenever the user gets into trouble, he or she can select the specific problem and get help. The problems related to disorientation and getting lost in the hyperspace can be considerably reduced by these mechanisms.

A list of clickable words and icons

The problem of missing important navigational tools can be overcome by providing a list of these items and encouraging the user to become familiar with them at the beginning. Also the users may select this list when they are not sure about the function of these items.

Guided tours

The Countryside Disc has the 'guide' function but it is not the same as the 'guided tour' function. The guided tour takes the controls completely from the learner and takes the user through the program. The problem with a complete guided tour is that the user becomes a passive viewer. It has been argued that guided tours are suitable for novice users and those who want to be familiar with hypermedia programs. However, guided tours cannot give the user the skills necessary to navigate alone within the hypermedia structure. History mechanisms such as bookmarks also allow the user to get back to the previous locations, but do not improve the navigational skills of the user. According to Marchionini (1990, p. 356) learning how to learn from hypermedia is 'a new type of literacy' that the learners must acquire in order to benefit from the new opportunities that hypermedia offers. Therefore, what is more important is to learn how to access information. The learners in the Countryside study lacked those skills, most of which can be provided by showing them the overall structure of the program, where an individual piece of information is located in relation to others, and how to move from one location to another. By providing a map of the structure of the program and getting them to practice specific manoeuvres, the programmer could help the users to learn from the program effectively. Guided tours are not considered essential.

10.5 Conclusions

The range of navigational problems the users faced were identified and categorised in this chapter. All the users experienced at least some of these problems during their learning sessions, as a result of the higher learner control given to them, and became 'disoriented' and 'distracted'. The implications of navigational problems for learning from the Countryside Disc were discussed and possible solutions were suggested.

The next chapter draws conclusions for the thesis.

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Chapter 11
Conclusions

This chapter summarises the main outcomes of the research, provides a critical reflection on the study and proposes recommendations and suggestions for further work.

11.1 Main outcomes

11.11 Proposing a computer-based approach for UK farmers' training

This empirical study proposed introducing a new dimension into the existing system of farmer training in the UK. Currently, farmer training in the UK is carried out using conventional methods and media. Chapter 2 argued that changes in the UK agriculture sector call for a rethinking of farmer training. Farmers in the UK face a growing concern from the public about the effect of farming activities on issues such as the environment, health, conservation, animal welfare, food safety and the rural economy. Farmers' activities are also governed by EEC regulations that are imposed with a view to preventing surplus production. EEC regulations are also shaped by the attitudes of the general public towards modern farming methods. Within this environment the average UK farm, a large mechanised business enterprise, tries to make a profit. A new wave of training needs emerge under these circumstances, not least because, in order to operate successfully, farmers need to reconsider how they make their farm management decisions.

Farmers need to be able to examine the impact of their management decisions not only on financial profitability but also on such issues as the environment and the economy surrounding their farms and villages. They need to take account of the regulations imposed by the EEC. Farmers should have a deep understanding of all the relevant factors involved in farm management. In traditional training, farmers undergo training to carry out a particular task competently. Conventional audio-visual media and methods are suitable for this type of training where the task of the media and method was to impart knowledge and skills.

Taking examples from the literature on other sectors of education and training and from the empirical work, Chapter 2 proposed that the special character of farmer training could be addressed by using computer-based media. They can provide learning experiences that involve active and independent inquiry into knowledge, rather than the farmers being passive recipients of knowledge and skills. Chapter 2 also argued that computer-based media could facilitate distance learning, thus overcoming farmers' problems in leaving the farm for training.

There has been no previous attempt in the UK to use computer-based media for farmer training, except the Countryside Disc. This study filled this gap, looking at how farmers learn from computer-based media in their own homes and offices. It highlighted their specific training needs and how the computer-based media could address those needs.

11.12 Evaluation of the Countryside Disc

The Countryside Disc was the first attempt in the UK to provide computer-based learning for those who are interested in the relationship between farming, conservation and the rural economy. However, since its production a decade ago, there is no evidence that it has been used by farmers. Also there is no evidence of evaluation of the Disc. As a result of using the program for this study, the Countryside Disc was introduced to farmers and the professionals involved in farmer training and advisory services. The data analysis (Chapter 6, 7 and 8) shows that, though the technology of producing hypertext-based learning environments has moved ahead, the teaching and learning model on which the Countryside Disc is based is still comparable to similar programs that have been more recently produced for other groups of learners. The concept behind the program is still valuable and applicable. The disc addressed the present-day training requirements of farmers. It enabled farmers to gain a deep understanding of factors to be considered when making farm management decisions; it enabled them to examine and experience the impact of their farm management decisions on the environment and rural economy. Farmers enjoyed using it, and said that other media would not have provided a similar learning experience. Compared with existing management software such as spreadsheets, the Countryside Disc is far more likely to encourage deep learning. The Countryside Disc is appropriate to their training needs. Analysis (Chapters 6, 7 and 8) and discussion (Chapter 9) showed that their learning experience was neither just superficial nor passive.

11.13 Emerging issues

Two issues emerged from the data analysis: the approach to learning and the learning outcome and the special character of the learning experience provided by the program.

The approach to learning and the learning outcome

There was an evidence of a positive relationship between the individual farmer's approach to learning from the Countryside Disc and the learning outcome. A deep approach to learning resulted in better learning outcomes and a surface approach resulted in the opposite. These findings are comparable with other findings reported in the literature on learning. The approach of the individual learner was changed, too, as he or she progressed through the program, due to the nature of the learning experience provided. The program required the users to go beyond just acquiring information. It required them to synthesise their answers relating the information to their own knowledge and skills. The process required them to face problems and reflect upon their actions. It required even the most surface learner to execute some deep level approaches, perhaps half way through an activity. Even the surface learners had to interact with the program because the program required them to do so; the program took them on a deep level exploration. The surface learners who just browsed and made decisions in a superficial manner showed some deep level features because the program required them to do so. They could not get away with less. Hence it can be concluded that no matter what approach the users adopted at the beginning of the task, the program took them towards a deep approach as they progressed through different stages.

The deep and surface approaches to learning have been studied in the case of print, audio, and a range of media in many educational contexts. They have not been studied with regard to computer-based media and distant learners such as farmers who learn in their own context.

The learning experience provided by the Countryside Disc

The Countryside Disc was able to provide the learner with a stimulating learning experience that took them through a deep approach. Chapter 9 discusses characteristics of the learning experience provided by the program in terms of the 'conversational framework' and the notion of a 'reflective practitioner'. The program was successful in providing the interactive activities essential in the 'conversational framework'. Being a simulation the Countryside program enabled farmers to act in a simulated world, but they were able to engage in a realistic learning activity for two reasons: the learner characteristics and the feedback provided by the program.

The ability of the program to give feedback on farmers' actions evoked reflections of two kinds: 'reflection-in-action' and 'reflection-on-action'. The important learner characteristic, i.e., experience in real life farming, was an added advantage; farmers were able to tap into their own experience in farming from time to time. This helped the reflective process. The feedback and the resultant reflective process they engaged in helped them to gain a deep and better insight into the learning task through a conversational-type learning activity with the program. The result was a deep approach to learning, no matter how the user first approached the learning activity.

This study, indirectly, applied the 'conversational framework' to an area of learning for which it has not been originally intended. The 'conversational framework was originally conceptualised for academic learning in higher education. This study applied the model farmers' learning from the Countryside Disc, and showed how the model could be applied to another area of learning for a completely different type of learners.

11.14 Identification of navigational problems

Another outcome of the study is the identification of a range of navigational problems farmers faced. It led to a discussion of the implications for learning from the Countryside Disc in particular and hypertext-based learning programs in general. The majority of farmers are novice users of such learning material, therefore navigational problems should be minimised as much as possible. A number of solutions were suggested to provide a problem-free learning experience. These findings could be useful in designing computer-based media for farmers' training.

11.15 A suggested model of interaction

Another outcome of the study is an in-depth inquiry into the phenomenon of interaction. The study began with an analysis of interaction leading to development of a model of interaction. The particular dimension of interaction that was investigated using the Countryside Disc was the 'learner-learning resources interaction'. Within this dimension, two types of interaction were studied: 'instructional interactions' and 'learner-interface interactions'. 'Instructional interactions' embrace activities that contribute to effective learning. Most of the data analysis and discussion dealt with the kind of learning experience provided by the program, elaborating on the instructional interactions. The notion of learner-interface interaction is concerned with the problems the user experiences when using an interactive medium. The analysis of navigational problems explains some aspects of 'learner-interface interactions'. The third type of interaction, systems interactivity, was not focused in this study, as it would have shifted the focus from the issues of learning into issues of designing multimedia. In this way this study suggested a model of interaction, a much debated issue in distance learning, and elaborated it.

11.2 Critical reflection on the study

11.21 Selection of the program

The reason for choosing this particular program, despite its limitations, was that it was the only program suitable for the current training needs of farmers at the present time. A more up to date program than the Countryside Disc would have created slightly fewer problems of content. The factual information on it was obsolete: prices of inputs and produce and the productivity of crops and livestock have all changed. Also, the technology of hypertext-based learning programs have developed and faster computers with CD-ROMs are now available. During the empirical study it was necessary to take precautions to compensate for the age of the Countryside Disc.

11.22 Selection of the respondents

As far as possible, the naturalistic paradigm was adopted in the study, within the time and resource limitations of a PhD study. Ideally the respondents should have been selected so as to maximise the variation of data, but the two training organisers were responsible for selecting farmers who would be interested in participating. Among those selected, there was some variations in their scale of operations. Another limitation of the sampling was that I had to select all 10 farmers before starting the study in order to make sure that the empirical work could be carried out during the limited time that the farmers were less busy. Ideally, the selection of the succeeding respondent is done after analysing the data of the previous respondent. That kind of approach, advocated by Guba and Lincoln (1989) would require much more time.

11.23 Pilot study

The pilot study was carried out in an office near the village where the farmers were located because at that time it was not possible to borrow the Countryside Disc and playback system. It might have been better if I had been able to carry out the pilot study also in farmers' homes, and give them more time to complete the learning tasks. It might have produced better results and provided a better understanding for the main study.

11.24 Data analysis

According to the naturalistic paradigm, data analysis is carried out immediately following each set of observations. The data of the preceding respondent are entirely analysed in order to widen or narrow down the focus of the study of the subsequent respondent. Due to the limitation of time, I had to modify this ideal method of data analysis. The farmers' were free only from November to March. I needed to fit 10 farmers into this period. After the pilot study, I decided that farmers needed at least one week's practice time. So the time left to analyse data from the previous respondent was only one week (this was also the time between two consecutive studies). During this week the previous respondent's data were transcribed and a preliminary analysis was carried out, but this was not ideal. In a few cases there was more than a week between two consecutive studies because some farmers had to change their schedule.

11.3 Recommendations for further work

Based on the findings of the study, some recommendations can be made for future work. Some of these recommendations have immediate applicability.

11.31 Producing a new computer-based program for UK farmers' training

The findings and experience gained from this research could be used to produce a similar learning program for farmers in the UK. The technology of producing hypertext based learning material have developed since the Countryside Disc was produced a decade ago. Also the factual information in the program has changed. Nevertheless, the model built into the simulation and the learning objective of the program remains the same, and even more applicable to present-day farming. So producing a similar package with up-to-date information using current technology such as CD-ROM has an immense value. A similar research could be carried out in order to understand more about how farmers learn from computer-based media and how far such programs helpful to fulfil the training needs. Such production and research activities would provide a wealth of information to the newly proposed farmer training system.

11.32 Research on the market for computer-based programs

Is there a market for computer-based farmer training programs? The only existing such program, the Countryside Disc, did not sell within the agriculture training sector which lacked the hardware or the experience to make good use of it. Will the same thing happen if a similar program is produced again? Research is needed on the likely demand.

11.33 Research on alternative uses

Another question is the farmers' access to CD-ROM players. CD-ROMs could be used by groups of farmers in their normal training, thus enriching the existing face-to-face training. This type of collaborative learning environment might overcome some of the limitations of computer-based media. Computer-based media cannot always answer all the questions that farmers may have, as observed in the Countryside study. Other farmers may act as valuable resources.

An important issue that will be raised with regard to the use of computer-based media for farmers' training is the ever-changing nature of information included in such programs. Due to change of the model and the information content, a program produced today may have a limited life span. For instance, the Countryside Disc does not take factors such as 'set-aside' land into account in its simulation model. Today farmers need to set-aside a percentage of their land. Also the prices of input and produce change. Another problem with buying (as opposed to renting or borrowing) a computer-based program may be that after using it a farmer may find it not useful anymore. As one farmer pointed out: 'it might be lying in the office somewhere gathering dust'. Some answers to these problems may be found in other emerging technologies such as the Internet.

11.34 Use of the Internet

The Internet could be used as the platform for production and delivery of computer-based learning material. The program could be produced by using an authoring language to create documents on the Internet, put on a server. A farmer with access to the internet could access the learning program. The program could be password-protected so that access was limited to only the interested parties. The farmer might pay for only the duration of usage, in addition to paying communication charges. The farmer would not have to buy the program on a CD-ROM. The producer of the program could update any information and even the model built into the program so that the user would always get an up-to-date program with up-to-date information. Information available on the internet could be linked to particular computer-based training material, thus increasing the range of information and reducing the cost of producing it. Use of the Internet depends on the availability of suitable machines on the farms and there would probably be some charge for the farmers' use of such programs and communication links.

There are other ways in which the Internet could be used for farmer training. The number of farmers who have access to the Internet and email is growing. The Internet providers advertise heavily its advantages for business communications. Some providers offer dedicated services for farmers. In addition to providing email facilities they filter out information related to farming in the UK and world-wide. Farmers can directly log into these information services. This situation is complemented by a large number of private sector agriculture companies who put information on the Internet, regarding the weather, prices of wheat and other commodities, BSE, etc. Due to the push from the service providers and the increasing availability of relevant information more farmers will have access to the Internet in the future. Out of the 10 farmers who took part in the Countryside study, three farmers began to subscribe to the Internet during it, and others who plan to do so.

What is still lacking is training material on the Internet. The ADAS has got a home page, providing rather a limited range of information for farmers. ATB Landbase does not have a home page yet. These advisory and training organisers could make use of the Internet by providing information and training material for farmers.

11.35 A combination of email and computer-based media

The increasing take up of Internet services by farmers, such as email, could be used to support computer-based learning by the farmers. During the period of the current study, the farmers who used the Countryside Disc, and their training organiser, were connected to the Open University's FirstClass conferencing service. The original objective was to maintain a support system for those farmers who encountered problems when using the Countryside disc. The farmers were able to email their problems to other farmers as well as myself. An important observation was that there were some farmers who discussed their problems related to farming activities. The training organiser also was involved in these discussions. Email could be used to supplement the use of such computer-based media as CD-ROMs. For instance, farmers may be able to discuss a particular program they used in a one-day training program.

11.36 Applications for developing countries

In addition to the direct applicability of this study to the UK context, this study has some implications for developing countries. The present situation in most developing countries does not permit the use of computer-based media for farmer training. However, with modifications according to the context, farmers in developing countries can benefit from this study, too.

Developing countries lack trained extension staff at the grassroot level. For instance, in Sri Lanka, the majority of grass root level extension workers were absorbed into the government civil service in the early 1990's creating a huge vacuum in the extension system. This was a severe blow to the country's extension program and reduced the training available for farmers. Developing countries in general face severe cut backs in government funds making it difficult to support the extension and training network. Distance learning, using print, recorded audio and video programmes and broadcasting, could be a useful alternative within this context. Despite the different technology addressed in this study, it is possible to use some of the findings of this study to provide guidelines for such an attempt. The research methodology and the learning models used in this study could be used to repeat similar studies on farmers' learning from such media. Given adequate resources, computer-based media too could be used to train groups of farmers in their training.

11.37 A model for agriculture extension

The conventional model practised in agriculture extension is derived from the communication model in which there is a sender and a receiver. The sender sends a message to the receiver, and based on the message the receiver may be able to give feedback. There is no true dialogue involved. The adoption of this transmission model has been cited as a reason for the failure of agriculture extension, especially in developing countries. The function of the sender is to send information that the receiver is believed to be lacking. This transmission model may be useful when the message that is being sent is factual information such as weather and market prices of agricultural produce. When the objective of communication is much more complex, such as imparting a deep understanding of the principles and theoretical base of a certain practice, this model is of limited value. In this research, the engagement between the program and the farmers during the learning process was much more complex, leading to a deeper understanding by the farmers. That engagement was best described using the conversational framework, a model that looks at the phenomenon of interaction from a learning point of view, and in much detail. Therefore, it would be worthwhile to find how the model used on this study could be adopted to the practice of agriculture extension.

11.4 Summary

The research reported in this thesis argued for the case of computer-based learning for UK farmers based on reviewing the examples from other areas of education and training and its own empirical work. It demonstrated that selected computer-based media can provide farmers who have training needs arising from changes in UK agriculture. The work discussed here has immediate applicability to the UK context, and with necessary modifications, to other contexts too. However, it is necessary to be concerned about the limitations of this research too. By applying the findings of this research and carrying out further research it should be possible to enhance the practice of computer-based media for farmer training, and the theoretical background on which the practice rests.

References

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Appendix 1
Special Cases

There were two farmers, namely Joyce and Ian , who had difficulties in completing the learning task, due to a range of problems. Some of these problems were similar to the problems encountered by the other users. However, there were unique problems, too. Appendix 1 analyses how these two farmers interacted with the program. This analysis will illuminate the specific problems they encountered and point towards the causes of such problems. This will add to the understanding of issues related to farmers' learning from computer-based media.

1.1 First case

Joyce took part in two learning sessions which I observed. Also she used the program on her own during the practice week. An important observation during the observed sessions was the constant support she needed in order to carry out the learning task. The usual method with all the other users was first to explain the structure of the program and the learning task. Afterwards they would start the program and watch the introductory videoclip. There would be some interventions when necessary. The level of intervention was much higher with this particular user.

During the first half hour with Joyce I explained the learning objective and demonstrated *how to select actions for a farm management plan* and to get feedback. Afterwards she started to use the program but I needed to give constant guidance, sometimes step by step instructions. The reason for my intervention was the range of problems the user encountered. However, there was evidence that she acquired the necessary skills for using the program, too. The problems and skills acquired are discussed separately.

1.11 The problems

Inputting information without a keyboard

The user, having listened to the introductory videoclip wanted a clarification of the learning task. I explained that the objective for the user was to prepare a farm management plan for the farm depicted in the program. Her immediate reaction was:

> You mean you want me to write that down, because I can't do it on there, because I haven't got my keyboard.

The problem seemed to be more to do with how to put her plan into the program than the nature of the learning objective. How could she input the farm management actions into the program without a keyboard? At the beginning of the session, I explained that she would not be using a keyboard; instead she would be using just the tracker ball to get information, make the plan and listen to the feedback. This approach seemed to be a novelty for the user.

I decided to demonstrate how to prepare and enter a farm management plan into the program. I explained how all the possible farm management activities are categorised into a list of 19 and how each category is sub-divided making different levels in the Plan. Also I showed her how to read what actions are carried out currently on the farm and how to select actions for the future plan. It seemed that she was still struggling to comprehend how to enter her decisions:

> But where do I put that down, do I write that on here (on paper)?

She still thought that she needed to write down the actions she was going to select on paper. I explained that once she decided on an action she needed to select that by pointing to that line and pressing the 'action' button on the tracker ball. The selected action would be highlighted. The user found this new approach still unconvincing:

> But where do I put that?

I further explained this new method of entering information into the program using the tracker ball to select options displayed on the screen. I also pointed out that it was easier to make selections from a list of options than to type using a keyboard. About this time it appeared that Joyce was beginning to understand the process of entering the user's own input to the program.

Joyce had limited experience with computers but was very keen to use one for her own farm accounting and budgeting. With this in view she had taken a few word processing and account management courses a couple of years prior to this learning session. She explained that she was not able to pursue that interest because of the family and financial circumstances she had to face later. The particular approach used in this program was completely different from her previous experience: there is no keyboard to write a farm management plan. She could not see how the information was to be entered into the program. It appeared that she took some time to come to terms with the new way of using a computer program. This situation had some implications for the way she used the program and achieved the learning outcome.

Understanding the Plan section and how to select 'actions'

The user had some difficulty in understanding how the Pan section works and how to select actions that would constitute a farm management plan. I demonstrated the Plan twice, once in the beginning of the first session and again towards the end of the same session. In addition, I helped her with the Plan during the second observation.

Level 1 is the list of 19 categories starting from the 'Land use' category. I explained how to go from level 1 down to the next successive levels. I selected the 'soil grade 2 fields' (from level 2) and field 2 (from level 3). I explained that she could select an action from the list of options (from level 4) by pointing to the desired action and pressing the 'action' button. Alternatively she could get an explanation for each field by selecting a field and pressing the 'change' button. I demonstrated how to get a page of information for field 2. Most of the information necessary for making planning decisions can be obtained this way. However, she had difficulty understanding:

> That is what you want me to do, to put on this piece of paper. this field I am talking about is next to the road.

Also there were other indications that she had difficulty understanding the task of the Plan:

> Right, what you want me to do is to talk about one field in particular?

Later she indicated that still she did not know how to make a decision when the program did not accept her decisions. She wanted to put field 2 for graze and conserve at intensity 2. The program rejected the action and the reason was the insufficient arable labour in October. Her reaction was that:

> *Well, how do I get grazing? Because I want to be able to graze my cattle!*

The next action should have been to look at the number of labourers currently being employed on the farm. It is necessary to have an understanding of the overall picture of the farm. because a lot of the actions are interdependent. Changing one action would destroy the present balance and would have a knock on effect on other actions. Joyce did not show that she understood this. She was not aware of how to go about making changes recommended by the program:

> How do I put down what labour I use then?

The situation improved in the second observation. Joyce started to work on the Plan after about 40 minutes of browsing in the Walk and the Office. She was able to select 'land use' category from the list of 19. She then selected the list of soil grade 2 fields and then field number 2. She eventually changed the cropping to winter wheat at intensity 1. This series of actions represent a correct approach to making a single decision; a set of such decisions would constitute a farm management plan. However, what happened next raised questions about whether she was selecting actions with understanding.

She immediately highlighted another selection, though the program accepted her first selection. Did she change her mind? Was the change of decisions based on some logical reasoning? Did she not understand how to make a change? Did she not understand that highlighting meant that she has selected an action? It seemed that though she was able to proceed through the steps involved in making a change, she was not quite sure what she was doing. She thought pressing 'change' button would change the action:

> 'Change' will change it, wouldn't it?

Following is the list of actions the user selected in this particular situation. The actions she selected are shown in bold.

0.46.31	**plan**
0.46.52	land use
0.47.05	soil grade 2 fields
0.47.10	Field 2
0.47.51	**winter wheat at intensity 1**
0.48.07	**winter wheat at intensity 2**
0.48.25	winter wheat, change
0.49.17	return
0.49.31	**winter barley at intensity 1**
0.49.41	grass for graze & conserve
0.49.55	**graze & conserve intensity 1**

Later in the second session too, the user made more than one change to the same action:

1.09.59	ditches
1.10.17	**dredge all ditches**
1.10.27	**do nothing to ditches**
1.10.46	**raise water level in ditches**

The problem she faced here was revealed when I asked her if she wanted to make any more changes before submitting the plan:

> I went to ditches, but I couldn't get anywhere there.
>
> I'd been there and it didn't do anything in that, get information.
>
> It didn't give any information.

From what she said, it appeared that she was not aware of how to get more information about different ways of managing 'ditches'. She needed to press the 'change' button rather than the 'action' button in order to get information. However, she had made use of the 'change' button before to read further explanations for a number of actions. For instance, on a previous occasion when I directed her to increase the number of cattle, the program did not accept that because of insufficient stock labour in February. At this point she indicated that she understood that it was necessary to look at an explanation. To get an explanation she knew that she needed to press the 'change' button:

> 'Change' for an explanation!

However, ten minutes later she was not able to perform the same function. She had also selected a number of actions previously. It appeared that she was not quite comfortable with the task in the Plan section.

I took her back to the 'ditches' category and showed her how to access further information once again. She read the information about one action under ditches and agreed with that action. She wanted to select it:

> Where, How do I do that then?

I told her that she had already selected the action because it was already highlighted. Her reaction was:

> I've done it. Have I?

There were other instances when she indicated that she was not very sure about how to carry out 'actions'. Particularly when she was looking at beef cattle below one year, she was not aware of how to increase or decrease the numbers:

> How do I do that then?

I showed her how to make changes to the existing numbers.

Joyce faced considerable problems while trying to make her farm management decisions. Some problems were related to understanding the structure of the Plan section and how it works. The other problems were related to the technicalities involved in selecting an action and getting further information about that action. The Plan covers more than a 100 farm management actions, categorised into a list of 19. These actions are put into to sub-categories making the seemingly complex level structure. The user needs to know how to go up and down through the structure of the Plan to get information and to make decisions. Also the user needs to have a good understanding of how to select an action and how to access a page of information related to those actions. In this particular case, Joyce's lack of such an understanding had implications for how she used the program and tried to achieve the learning outcome.

Finding relevant information and making sense of it

There were instances when Joyce indicated that she was unable to integrate the information she obtained from the program into the learning task. For example, when she wanted to decide the number of cattle she was going to have on the farm, she selected an action, but the program rejected it. She read an explanation for it and said that she already had read that piece of information before. It appeared that she was not going to make use of the piece of information she had read:

I read that before (reading the information on the screen). "Don't forget you need to allow sufficient grazing space in the summer and produce sufficient food for the winter. You also need to provide sufficient labour effort. These factors can be controlled separately". I have read that before.

She was going to put 180 cattle and the program did not allow the action on the ground that there would be insufficient arable labour in March. I indicated that perhaps it might be helpful if she knew the number of labourers currently being employed on the farm. It appeared that she did not have that piece of information:

I don't know. Where do I get the labour from now?

She did not understand what kind of information was necessary to solve the problem and where to find that piece of information. I showed her where to get the information about 'farm workers'. When she knew that there were 3 stock workers employed at the moment, she was puzzled:

You need three stock workers for 180 cattle? Is that what it means?

Her interpretation of this piece of information was not correct. These 3 labourers were responsible for managing other stock operations as well. In order to have that understanding, the user needed to have a thorough understanding of the farm as a whole. It appeared that she did not think that the actions she tried to put in were going to be a part of the whole set of actions going on. She was thinking of each action on its own. I helped her to go through the list of all the stock operations and make necessary changes so that she could accommodate her decisions.

Another instance was when the program rejected a proposed action. She wanted to increase the cattle numbers and the program rejected it on the ground that there will be insufficient stock buildings. Next, she would read a further explanation or/and go to the category where she could increase the stock buildings. She was not aware of the location of this section:

Where is farm buildings? Extra barns for livestock?

After making selections on the livestock operations she wanted to submit the plan without looking at other categories where she could make decisions. When I pointed out this possibility she indicated that she was not aware of that:

What are they?

Working on the Plan section requires a comprehensive understanding of its structure and the way it functions when the 'actions' are selected. An equally important factor is the skill to manage the information that can be obtained from the Plan. One needs to know what kind of information is necessary to make a certain farm management decision and where to find it. Also it is necessary to know how to make use of information in order to make decisions. On the one hand, making farm management decisions using the Plan section is similar to the way in which a farmer goes about making such decisions with just pen and paper. One takes all the available information, assesses risks and decides on a set of actions. The difference here is that the program evaluates certain actions and rejects them if those actions violate the rules built into the program. Also the previous decisions made are not visible, unlike writing on paper (Most of the other users chose to write their actions first but this particular user did not make use of pen and paper). When the program rejects an action, the user needs to know how to find out the reason for the rejection and where to get information to make a decision that can be accepted by the computer. So, in order to make use of the program the user needs to have a better information management skill. It appeared that these factors influenced how she used the program.

Seeing the program: as a learning tool or a management tool for a specific task?

The user had difficulty distinguishing this particular program as a learning tool. There were a few instances when she appeared to think of the program as a management tool for her to manage her own farm. When I asked her the number of labour units she preferred to have for her management plan she said:

> We've got to do it with the labour we've got. I'm not going to employ anybody else!

When two labour units were put into the program, it rejected the action on the ground that there would be insufficient labour in October. I pointed out that if she were to go ahead with her action she needed to increase the number of labourers employed on the farm. She did not want to increase the labour. She thought she was going to manage the farm with the two farm labourers she has got on her own farm.

I tried to point out the fact that she was managing the farm depicted in the program and need to know the number of labourers employed at present. She still referred to her own situation:

> Just two (her sons) and myself, that is all I have got on this farm.

After doing a series of actions and exposing more information about the farm I was able to convince her that she should be concentrating only on the farm depicted on the program:

> No. I think I better work on this.

However, when it came to transferring the knowledge she was going to get by managing the farm in the program into her own situation she had doubts whether it was possible:

> But I won't be able to apply it because I've got about 229 acres, you see, so it is a lot smaller than that.

Another situation when she thought about the program as a management tool for a specific task was when I asked her if she wanted to increase the number of heifers aged less than a year. Her reaction was that:

> It is not relevant to my business. We haven't got 100 heifers on the (farm).

The distinction between the two kinds of approaches, computers as a tool for learning and computers as a tool for managing accounts and budgeting was a somewhat difficult point to get across to this particular user. This was a problem for Ian, too, whose interaction is discussed later. Joyce had come across only two kinds of computer software: word processing and farm account and budget management programs. A computer program for learning or training was a novelty. That may be the reason why from time to time she was trying to think in terms of her own situation during the learning session.

Navigating

<u>*Selecting the wrong clickable word*</u>

On several occasions, Joyce selected the wrong clickable word from the screen. These actions put her into difficult situations. She struggled to move back to the previous screens and continue navigation.

The first occasion was when Joyce was just going to select 'simulation' from the main menu in order to use the program on her own. I was going to ask her to select 'Simulation'. Before that she clicked on 'change' on the bottom menu bar of the screen. Usually this is done when the user wants to change the values of the program and to adapt the simulation to his or her own farm. The screen asks if the user wants to input new values from the floppy disks. The user could erase the current values had he or she continued to answer the questions displayed on the screen. I explained that changing values was beyond the scope of the learning session and directed her to select 'Exit' and to get back to the previous settings.

The second occasion when Joyce selected a wrong clickable word was soon after beginning to read a case study within the Office. Here, she selected 'Menu'. This is one of the mistakes a user could make: it takes the user back to the very beginning of the program. When this happens, the user needs to select 'Simulation' to restart the program. This time Joyce not only selected 'Menu' but also selected 'Change' from the menu bar. As explained previously, this would allow her to change the values of the Simulation, if she wanted to. However she did not proceed to change the values but kept on selecting the following clickable words continuously: 'Info'; disappear menu bar; reappear menu bar; 'Return'; 'System'; 'Return'; and finally 'Info'. At this time she seemed to be worried about what was happening:

> Can't seem to get off this bit.

She seemed to be trapped in an unintended section. Her problem was how to break this circle, to get back to the section where she was before. I suggested that she should select 'Exit' from the menu bar. She was able to get back to where she was. Also I suggested that she should avoid selecting 'Menu' unless she wanted to go back to the beginning of the program.

The third instance when she had a difficulty was when she wanted to listen to the videoclip that shows the farmer who currently runs the farm. She selected the VCR from the Office the first time without trouble. But she stopped it thinking that she had listened to it before. When I explained that she was listening to it for the first time, she wanted to get it again. However, instead of selecting the VCR from the Office she selected 'Menu'. This took her back to the beginning of the program. So she had to select 'Simulation' again and restart the program.

The fourth instance was just after listening to the spokesperson for the first interest group. She selected 'Menu' followed by 'Change' on the menu bar. I was trying to stop her selecting 'Menu' but she proceeded with her action. Also I tried to stop her selecting 'Change' but was not successful. Afterwards I advised her to select 'Exit': she was able to restart the Simulation and go into the Office.

During the second observation too the user found herself selecting 'info' followed by other unnecessary clickable words. The first instance was while looking at photographs of wildlife. She kept selecting three photographs and corresponding textual descriptions. Soon after that she selected 'Info' followed by 'Help' and 'Guide'. It appeared that she did not really want to read the 'Help' or view the 'Guide' for the Walk.

It is interesting to note the pattern of these unintended actions and to analyse the underlying reasons. Some of these actions are to do with the meaning of certain clickable word. The user may have misinterpreted the meaning of some words depending on the situation she was in. For instance, she may have selected 'Info' when she was looking at photographs of wildlife thinking that 'Info' would give more information. As far as the pattern of these mistakes is concerned, it appears that Joyce tended to select unwanted clickable words when she had gone several layers deeper into the program and when she wanted to get to a new section. So, it may be that the selecting an undesirable word is an indication of a navigational problem rather than a problem on its own.

Progressing

After looking at the photographs and textual descriptions from the first page of an essay the user selected 'Info'. After looking at the screen for a while she asked:

> How do I get the next page? ... Does that come after here?

The user wanted to go to the next page and thought that she needed to select 'Info' for that. In order to turn the page the user needs to place the pointer to the right of the screen and select the 'Change' button on the tracker ball. She was able to read the rest of the pages after I gave her instruction.

A similar incident occurred after reading the last page of this particular essay. This time too she selected 'Info' followed by 'Help'. She did not want to read the Help:

> No, I wanted to get rid of that

She wanted to exit from the essay she had just read and access the next essay. She found it difficult to do. I explained that she needed to select the Return arrow in order to get to the original list of essays. She then selected the next case study.

Moving from one section to another

Just after she started the second session, it appeared that she had already made some changes to the existing plan. I suggested to her that she should select 'Restart' in order to make a fresh start. She was trying to move from the screen with the 'Guide', to the screen where she could restart the program. She found herself struggling to do that:

> I found it almost impossible to get out of one section!

This difficulty of moving out of a section may be why she clicked on the wrong words such as 'Info' and 'Menu' several times.

Another instance when she had similar difficulty:

> I can't get out of this section!

Following is the extract of the navigation in this particular section:

0.56.01	120 heifers below one year, change
0.56.33	return
0.56.45	120 heifers below 1 year, change
0.57.01	info
0.58.20	help
0.58.34	return
0.58.55	info
0.59.06	help
0.59.46	return
1.00.02	return
1.00.42	up

She was looking at further information on cattle numbers and looked at a 'Help' page. Then she wanted to get out the pages that gave further information on cattle numbers. She selected 'Info' thinking that she would be able to get out of the section. Soon she realised that she was clicking on the wrong button. Also she did not know how to get out of the section:

> I can't get it out of this now.

She then selected 'Help' thinking that it might be of some help:

> (reading the help screen) "You are in the Plan section, you have placed the pointer over a particular name and pressed the 'Change' button." Action, left hand, is that this, oh no, 'action'.

She was struggling to understand how to get out of this section. I advised her to select 'Return'. This action took her back to the previous screen with the information page on the cattle numbers. She had just seen that page:

> Oh, no I've had that, it keeps coming up.

The problem was that she needed to select 'Return' again in order to get one more screen backwards. That would have taken her back to level 3 in the livestock category: that is where she tried to make a change to heifers below one years old. When she came to this screen she told that she wanted to go to the level where she would be able to select other animals. That means the level 2 within the livestock category:

> Well I wanted to get onto the other animals, where it says sheep and that ... .

The problem is associated with understanding the level structure within the Plan and how to navigate up and down the levels. In order to proceed, one needs to select a line from the screen and press 'action' button. This way one could go down to level 2, 3, 4 and so on until one comes to the level where it is possible to select an action. To ascend within this level structure, one could chose two ways: select the clickable words 'Up' or 'Top' on the menu bar. By selecting 'Top' one could get directly back to the level 1, the screen with the 19 categories of actions. However, if one needs to ascend level by level. that is from level 5 to level 4, and then to level 3 and so on, one needs to select 'Up', on the menu bar once at time. On the other hand, in order to get a further explanation for a certain action, one needs to select the line for which the explanation is needed and press the 'change' button. It is not possible to proceed to another level from this screen. One needs to get back to the previous screen or the level by selecting 'Return'. Afterwards it is possible to ascend or descend through the different levels. It is easy to be trapped in this structure. That may be the reason why this particular user found it difficult to get around the Plan, not once but a number of times.

Maintaining a steady navigation pattern

The program is designed in such a way that the user can access any section, at random. It is not necessary to follow a linear path. Once the user is in one section getting information from a certain component, for instance listening to the opinion of an interest group, he or she can go to Walk and look at a photograph of wildlife or go to Plan and try to make a farm management decision. However, this kind of pattern result in a haphazard navigation. There was evidence that Joyce was following such a pattern. Following is one such instance:

1.08.16	Return arrow
1.08.29	**action**
1.09.30	plan
1.09.52	office
1.10.06	television
1.10.26	**parish council**
1.11.27	**back ground**
1.12.24	Return arrow
1.12.37	**action**
1.13.41	Return arrow
1.13.56	**summary**
1.15.17	office
1.15.31	**files**
1.15.53	Return arrow
1.16.12	computer

Here the user went to the Plan after listening to only two of the interest groups. I asked her if she would like to listen to the other interest groups before making her decisions in the Plan. She agreed and listened to the spokesperson for the Parish Council and read more information about the opinion expressed. Then she went to the files, a section she had already been in. However, without looking at any of the essays, she selected the 'computer'. It is not clear why she followed this random type of navigation.

Another instance was when the user was in the Walk. She went on to restart the program. But after coming back she went to the Office; clicked on files and without looking at any of them selected the Office screen again.

0.08.31	Return arrow
0.08.40	**menu**
0.08.51	**restart**
0.09.04	**simulation**
0.09.39	**info**
0.10.29	return
0.11.06	**office**
0.11.22	files
0.11.43	office

A third instance was later in the plan section. Joyce went to the Office, selected the VCR but did not listen to it, selected the computer and looked at the estate finances and again returned to the plan section.

0.52.08	**office**
0.52.30	**VCR**
0.53.25	**office**
0.53.38	**computer**
0.53.54	**estate finances**
0.54.53	**plan**

Accessing information

There were several incidents when the user wanted to access some information and was unable to do so. The first time was when she wanted to look at the files. She had done this manoeuvre during the first observation. Perhaps she had read them during the practice week, but now she could not:

> I thought you could get something on that one (files) ... . I did the other day and I can't now.

The next incident was immediately after that, when she wanted to get a photograph of the location she had selected the map. She clicked on the blue indicator on the map and found that she was not able to get the photograph:

> How do I get that? (clicking on the blue arrow on field 31) ... . I wanted to get the picture of that field... .

The correct way was either to select 'Description' to get a photograph together with a location description or to select the Return arrow to get the Walk screen with arrows. She was able to do that once reminded of how to do it.

Another instance of when Joyce found it difficult to access certain information was during the second observation. She was looking at the livestock category specifically the cattle. She made a change to the numbers and the program did not accept the change due to lack of labour in March. Then she looked at further information, twice about the same item. At this point she selected 'Info' and found that she was getting into the same trouble, the vicious circle where she could not get out:

> I can't get out of this now!

She read the 'Help' and selected 'Return' at which the textual explanation for cattle numbers were displayed. This was the same page she read before:

> Oh! No. I have had that. It keeps coming up.

She indicated that she was trying to get to the level from which she could select other categories of livestock:

> Well I wanted to get onto the other animals, where it says sheep and that ... .

I suggested that she should go a few levels up until she saw the categories of different livestock, which she did. Then she started looking at other animals.

1.12 The skills

There were certain instances when the user showed evidence of acquiring the necessary skills for using the interface for navigation within the program.

Looking at the photographs and descriptions of case studies

I showed her how to access the case studies within the Office. She selected 'ponds and ditches' whereupon the first page appeared. I showed her how to read the other pages and access photographs and textual descriptions. Afterwards she continued to look at the rest of the photographs and textual descriptions without asking for any help. Selecting photographs and textual descriptions requires manoeuvring through different layers of the program and needs some skills. Joyce seemed to have acquired them.

Looking at the photographs and descriptions of wildlife

Within the Walk section, I instructed Joyce how to do most of the manoeuvres step by step. Afterwards she continued to look at the lists, photographs and textual descriptions of plants, but she did not do any other manoeuvres such as moving locations, reading descriptions of locations etc. Was it too difficult for her to make such moves?

Joyce was able to look at the photographs and textual descriptions of wildlife alone during the second observation as well. Specifically, she showed considerable skill when she was interrupted by her family. Her daughter and granddaughter visited her half way through the learning session. She showed the photographs of wildlife to her granddaughter for nearly half an hour. Also she taught her granddaughter how to use the program:

> I'll show you something in a minute. Let's see if I can find something for you to look at ... . remember, come down here, press that, wait a minute, it is a bird!!!

Joyce showed some skills in using the Walk and the Office to get information. She was able to look at photographs and textual descriptions. This is significant because the user needs to be able to select items from lists and clickable words from the menu bar. However, she faced difficulties moving from one section to another. For instance she found difficulties when she tried to move from one essay to another. Also the data show that she found difficulties in moving between major sections.

1.2 Second case

The second user who was not able to complete the learning task was Ian. He too took part in both the learning sessions which I observed, and used the program during the practice week.

1.21 The problems

Ian faced a range of problems, despite the fact that he approached the program with considerable confidence and skill (discussed later). He was not able to complete the learning task, i.e., preparing his own farm management plan based on the information obtained from the program, and getting feedback for it.

Understanding the learning objective

It was doubtful whether Ian was working on the program with a reasonable understanding of the learning objective. There were indications that he was not aware of the specific task within each of the main sections – the Walk, the Office and the Plan. The introductory videoclip presents the learning objective to the user at the beginning. Once the user is in the individual sections, he or she needs to know more about those sections and how to get the necessary information.

There are three ways the user could get this understanding. Firstly, the user could listen to the 'Guide' and read the 'Help' for each section. Secondly, the user could try to understand by himself or herself while accessing pieces of information within each section. Thirdly, he or she could seek help from me. These three methods worked reasonably well with the majority of the other users. However, there were indications that Ian was not able to understand what was expected of him, sometimes even with the three types of help mentioned above.

Ian faced the first problem when he went to the Office. I explained that he could listen to the 'Guide' and read a page of 'Help'. He listened to the 'Guide' and returned to the Office screen again. He did not select individual items such as the 'television' and the 'VCR'. Instead he asked:

> Where do we go? To Plan?

I advised him to read the 'Help' page and explore the Office. He then managed to get information from the 'computer' and the 'VCR'.

He did not seek any help when he went to the Walk. Instead, using the arrows, he walked around the farm. He clicked on arrows 41 times. Later he accessed the map, read a description for the location he was in and accessed the list of plants. But he found himself not knowing what he was doing:

> You could spend ages doing this, couldn't you?

This was after five minutes in the Walk. Immediately after making this comment he went to the Plan section.

While in the Plan too, Ian did not make any attempt to know about his task. He browsed the section, looking at the 'land use' category and reading some further information about a couple of actions he could do for a particular field. After about three minutes he listened to the 'Guide' for the Plan. He then read the 'Help' page. Still he was not able to comprehend his task within the Plan:

> So what do you want? Where do we go from now?

I explained the learning objective and suggested that he should go back to the Walk to get the information he had missed. I explained about the kind of information available in the Walk and how to access it. After being in the Walk for about 11 minutes he was still not clear about the task:

> So what do we do from now? I could spend years doing this?

During this learning session the user was not expected to access every possible piece of information from all the three sections. Such a task would not be possible because of time limits. So the task for the user during this session was to understand the kind of information available, practice the navigation procedures and relate the information to the final learning objective. Ian perhaps showed he had failed to understand the task given to him.

I suggested that he should go into the Office again in order to look at the kind of information available. I showed him some of the information he missed. Then I briefed him again on the learning objective. Ian had difficulty comprehending how to make a plan:

> How do you make a plan using this, though?

Afterwards I led him to go to the Plan and showed him the process of selecting actions for the future management of the farm.

It is important that the user understands, as soon as possible, the learning objective and how to achieve it. Browsing the program without really knowing what to do with the information results in fruitless navigation within the program. Ian faced this situation for the most part of the time he spent on the learning sessions. By contrast, the majority of users, that is seven out of nine, were able to understand the learning objective and how to make a plan soon enough so that they were able to experience a productive learning session. It is important to study Ian's specific situation.

Navigating

Difficulties in progressing

Compared with the other users, Ian had fewer difficulties in progressing through the program. One problem he faced was while he was reading a page of information related to the 'Guide' for the Office. After reading the page he was not able to progress:

> How do I get beyond that?

The problem he faced was partly related to the design of the interface. There was no indication whether the user could go forward accessing more information or whether he or she had reached a 'dead end'. In such a case, the user needed to go backwards and look for other information. In order to go backwards the user needed to select 'Return' from the menu bar. This incident occurred within the first few minutes of using the program. After I showed Ian the clickable word 'Return' on the menu bar, he was able to get back to the previous screen. He did not face the same difficulty later on during the learning session.

Difficulties with certain manoeuvres

These problems are associated with the lack of special manoeuvring skills required in order to get information from various sections of the program.

The first problem Ian faced was how to get back to a previous screen. He was reading information from the balance sheet and wanted more information. Without knowing, he selected 'Info' on the menu bar. The clickable words on the menu bar changed as a result. He knew that was not what he wanted:

> I want to go back to the previous [screen].

What he wanted to do was to get back to the previous screen with the list of four kinds of farm accounts. He wanted to select another farm account. The way to do this was to select the Return arrow.

Another problem he came across was how to read the next page of a text. Ian was looking at the list of animals at a certain location and wanted to know how to read the next page:

> So how do you page down?

In order to look at the next page the user needed to place the pointer at the right hand side of the screen and press the action button. Once shown, he was able to look at the second page of the list of animals.

A third problem was to know how to navigate via a short cut. Within the Office Ian was viewing the videoclips containing the opinions of interest groups. He listened to one spokesperson and selected 'Office' to select a spokesperson from another group. This took him to the Office screen. From there he needed to select the 'television' followed by the desired interest group from the list appearing on the screen. Ian wanted to know if there was a quicker way:

> Is there not a quicker way instead of, if I want to see anything else?

Ian was knowledgeable enough to think that there should be a shorter route to access the next interest group. However, he did not know how to do it. The usual method is to select Return arrow to get to the previous screen, that is, the screen with the list of interest groups.

Missing vital information

Ian missed a lot of information from all the three main sections of the program.

While in the Office he missed the interest groups that can be accessed via the television and the case studies and associated photographs that can be accessed via the 'files'. He also did not notice that he could enter into the Walk and access the map from the 'Office'. He managed to access only the farm accounts and the videoclip giving background information. Later on I took him to the Office again in order to show him the sections he missed.

Within the Walk too, Ian took in limited information. He spent only six minutes in the Walk the first time and used only arrows to walk. Three other things he did in the Walk were to access the map, read a location description and look at the list of plants. These manoeuvres he did just once. Also there were no indications that he was doing these manoeuvres knowingly. He missed were getting the panoramic view and accessing photographs and descriptions of wildlife. I took him to the Walk again and showed him the kind of information available.

Missing vital information could be considered a major weakness in Ian's pattern of accessing information. Especially within the Office he missed the opinions of interest groups, a major component of information that can influence the user's decisions for the management of the farm. Opinions of interest groups help to measure the success of his or her actions. The case studies that he missed provide supporting information for many of the farm management decisions. It is important to study the reasons for Ian missing this vital information.

Not knowing about certain manoeuvres

Ian did not make use of all the possible manoeuvres while he was in the Walk section the first time. The only manoeuvre he carried out was to use the arrows at the bottom of the screen to walk around. This too was not very methodical as he just kept clicking on arrows without trying to grasp the location in relation to the farm, and without reading descriptions of those locations. Also he did not make use of the direction indicator in order to understand the direction he was looking at any particular time. He was getting a panoramic view a couple of times but he was not aware of it. Later on, I showed him how to select locations using the 'map', how to use the 'direction indicator' to get the bearings and how to use the 'arrows' to walk methodically.

A successful learning outcome is partly dependent upon the user's ability to access necessary information from the program. The user needs to be able to employ various manoeuvring procedures built into the program in order to access information. Especially within the Walk section, Ian was not aware of how to move around the farm quickly and to access information from each location selected. This probably had an effect on his understanding of the farm and on the final learning outcome.

Personality

Impatient

Ian appeared to be impatient during both the learning sessions. This condition had some negative impact on the learning process and the learning outcome.

On one occasion he kept on selecting a series of clickable words and icons without waiting for the program to respond to the previous actions. He was looking at the list of farm accounts within the Office. He wanted to select one farm account from the list. Instead he clicked on the Return arrow. This would take him back to the Office screen. Instead of waiting for the program to respond, he clicked on the same icon. Again without waiting, he selected the 'estate finances' from the list. By this time the program began to respond to his previous two actions, and the Office screen appeared. As the screen was changing he commented:

> Ah! That's interesting, I wanted to go to, I've gone back, not to where I wanted, I wanted to go to 'estate finances' ... .

Had he waited for the program to respond to his actions, he would have understood the program's response better.

Later in the Walk section he came across the 'direction indicator'. He appeared to be asking himself what the icon represented. However, without waiting for an answer from me or trying to understand it by himself, he selected it. The screen changed. He continued to select it. It was clear that he did not understand the function of the 'direction indicator'. All he could see was that when he selected that icon the screen changed. He continued to select it seven more times. Also he selected it continuously later on. When he was in the Walk section later, he talked about the function of it:

> It does a round thing, doesn't it?

Perhaps Ian thought he could look around the location by clicking on the 'direction indicator'. This understanding was not correct. The arrow of the 'direction indicator' shows where the user is looking at a particular moment. With each click on the left or right of the screen, the direction of the arrow changes. What actually happened on this occasion was when he clicked on the 'direction indicator', the program responded as if he were clicking on the left of the screen, because the icon was in the top left quarter of the screen. The whole left and right halves of the screen are responsive in this program. So whenever he clicked on the icon, the left panoramic view appeared. Had Ian been patient enough to stop and understand what was going on, he would have understood this phenomenon.

Later in the session, I directed Ian to go to the Walk section in order to look at the information he had missed previously. He immediately clicked on the section of the menu bar that deletes the menu bar altogether. A user would do this if he or she wanted to use the keyboard instead of the tracker ball to use the program. I had told him that would not be necessary. However, I showed him how to retrieve the menu bar again. Afterwards I directed him to get to the Walk section. But he immediately selected 'Menu'. By selecting the 'Menu' the user directly goes to the main menu of the program. Usually this is done if the user wants to restart the program or to stop the program. Ian could have avoided taking this unnecessary step. There were other occasions, too when the user was not able to follow my instructions. Also there were signs of impatience while I was giving instructions on how to use the Plan section and how to access case studies from the 'files' within the Office.

From the beginning of the second learning session, Ian was not happy about the way the program was responding to his actions:

> This drives me dilly, this!
>
> Well, I just tried increasing the cow numbers.

He was trying to increase the number of cattle but the program was rejecting his action. In this occasion he needed to read more information about cattle numbers and understand why the program rejected the new action.

Soon after this incident Ian selected 'Menu' to take himself back to the beginning of the program. In the first session too he had come to this point but them he managed to get back to the program again. In this particular occasion he continued to select various clickable words on the menu bar. First he selected 'Change'. A user should do this if he or she wants to change the values assumed in the program. The user could put his or her own information into the program. Ian made a serious error: he inadvertently answered the questions on the screen and the values of the simulation were changed.

After this series of selections he realised that he had got into a position which he did not wanted to be in:

> I don't know how I got into this.

I directed him to get back to the program. Until very late, it was not possible to detect what had gone wrong. As a result of the changes he made to the program, the behaviour of the simulation changed. He was unable select many of the actions he wanted. This situation affected the second session considerably. Had Ian been a bit more patient and conscious of the words and icons he was selecting, the second session would have been more enjoyable for him.

Impatience was Ian's main characteristic during most of the first observation and almost throughout the second session. He would normally select more than one clickable words or icons before the program had time to respond. Also he would continue to select words and icons without trying to understand what the outcome would be. This style of learning got him into great trouble: there were several situations where he could not understand why a certain screen appeared or did not appear. Also the second session was completely non-productive because he changed the behaviour of the simulation inadvertently. The program is to be blamed to some extent due to its slow operating system. Some of the sections such as the lists of wildlife and videoclips are slow to come up. However, almost all the other users got used to the pace of the program, and got the most out of it. Ian's impatience considerably affected the learning process and the outcome.

The commitment

Towards the end of the first learning session, Ian thought that the program required much more work than he expected:

> Do you have to do this in your plan? Do you have to actually put. look at every field in turn and do a plan like that?
>
> Crickey! sounds like an awful lot of work!!

The users were free to decide on when and how long to spend on the program, during the period it was with them. Ian appeared to be unhappy that especially the Plan section required more work and time than he originally thought. In fact the way he did the second session was quite different from the most of the other users. Ian did not have any written notes that would have provided evidence that he had studied the program. There should have been notes on the current input levels and actions. Most users had taken down notes on the field numbers, field sizes, current cropping, livestock numbers etc. They consulted these notes while doing the second session. Ian did not have any notes. Perhaps the lack of commitment affected the learning process and the outcome.

Work-related problems

The first learning session was interrupted by telephone call and personal callers. The first interruption occurred about 15 minutes after starting the program. A farm staff member came to talk to him. Then there was a telephone call from his employer who wanted to talk about an urgent matter. His employer wanted to pay a personal visit within the next half hour so we had to rush the rest of the session.

Ian was disturbed by the two interruptions during the first session, especially the fact that his employer was going to make a sudden visit. There was an interruption during the second session, too. This kind of work-related problems may have occurred during the time he had the program for himself. Ian had to keep the program for more than a month, because he was not able to fix a date for the second session due to work. He had to postpone the second session four times. Also the whole observation was first scheduled for the second week of February 1996 and had to he rescheduled for the third week of March 1996. Ian's learning sessions overlapped with the beginning of the busy period. This kind of work-related problem may have affected his learning from the program.

1.22 The skills

Ian started the program with reasonable confidence in his skills of navigation. After my brief introduction to the program, he started the program by selecting 'Simulation' from the main menu without waiting for any help. Having listened to the introductory videoclip he wanted to know if there was a particular order in which he was required to get information from the Office and the Walk. I informed that he was free to explore any section he wanted, and he went to the Office without hesitation:

> Let's go to the Office first. (placing the pointer at 'Office' on the menu bar) there.

At the Office' I informed him that he could access a 'Guide' who would explain the learning activity within the Office. He was able to understand how to access the 'Guide':

> That's in 'Info'. Isn't it?

Ian knew that he needed to select 'Info' in order to get the 'Guide'. He needed only a partial guidance as to whether to select 'Help' or 'Guide' next. After listening to the guide he read a page of further information related to the guide. Ian commenced the learning activity using the program without difficulty.

Ian fast acquired some of the navigational procedures. One such procedure was the use of the Return arrow. This is used to get back to the previous screen. On one occasion (discussed under navigational problems) Ian wanted to know how to get back to the screen showing the list of four farm accounts. He wanted to select a page of information from that list. After I showed him that he could use the Return arrow to get back to the previous screen, he continued to use it. He was good at learning and applying new skills.

Having been in the Office for some time he moved to the Walk section, again without asking for any help. Within the Walk, he started using the arrows at the bottom left hand corner of the screen, to do the walking. After a while he accessed the map, location descriptions and lists of plants without any trouble.

Moving to the Plan section too was not a problem for Ian. After being in the Walk for some time he selected the Plan from the menu bar. He then selected the 'Landuse' category from the list of 19 categories of actions. Afterwards, he selected soil grade 2 fields from the three soil groups, and finally made a selection for field number 2. All these selections were made without any help from me. Also he was able to understand that he could get an explanation for an action by pressing the 'change' button.

1.23 The learning outcome – supports reflection

After making a few changes, Ian submitted a plan for the future management of the farm. He then got feedback for the changes he made. He listened to the representative of the Parish Council who disliked his plan and wanted him to change it. These comments made him think about the reasons for the feedback:

> This is because I wiped off the ... [large housing development]

What he did in his actions was to cancel a 'large housing development' proposed for the field number 2. Instead, he wanted to grow winter wheat at intensity 1. He tried to understand the reason for the spokesperson's feedback. He then wanted to know more about it:

> Can we go to the 'Background'?

He wanted to read a page of explanation related to the feedback just given. In fact he read two explanatory pages before returning to the Office. In the Office he looked at the farm accounts and compared the financial changes due to his actions:

> By changing that (looking closely at the figures) ...

He began to understand more about the consequence of his actions. Also he understood more about how the program works:

> Ah see this is like a what if ...

The user got feedback for his actions and tried to understand the reasons for the feedback. This is the nature of the learning experience the program provides to the learner. By this time the user had spent more than an hour on the session, and he wanted to end it because he had to attend to urgent work that came up. Due to the various problems discussed above, it took a long time for the user to understand how the program works and to appreciate the learning experience.

1.3 Conclusions

Appendix 1 analysed the range of problems the two farmers encountered during their learning sessions. A similarity with the other users was the kind of navigational problems they faced. These navigational problems affected their learning to some extent. Comparatively, Ian faced fewer navigational problems and approached the program with considerable confidence. However, he was not able to overcome the some other major problems, so his learning session was greatly affected.

As far as Joyce is concerned, the Plan section was the most difficult section for her. The problems she came across were mainly related to her lack of exposure to the special type of learning experience provided by the program, the way of using the program (using a tracker ball instead of a keyboard), the technicalities involved in using the program and the information handling skills required to complete the learning task. She was fairly comfortable with the Walk and the Office. These two sections function as 'multimedia resources'; the user only needs to know the technicalities of accessing information from various sections. The user did not have to put her own inputs into the program; neither did she need any information handling skills. However, in these sections too, she had difficulties when the manoeuvres were complex.

Ian's major weakness was that he was very impatient with the program and kept on selecting words and icons without waiting for the program's response. This manner got him into difficulties. Especially during the second session, he managed to change the behaviour of the simulation. Also there was evidence that Ian was not totally aware of the objective of the program. Finally there was disturbance from work-related problems during the learning session. All these factors affected the learning process.

Appendix 2: A detailed map of the farm

KINGSTON HILL FARM AND SURROUNDING AREA